ELECTRICAL SOUTH

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The Utility Engineering Section of this issue begins on page 73

OCTOBER 1958

ABSOLUTELY NOTHING LIKE IT FOR QUICK INSTALLATION AND COMPLETE FLEXIBILITY

Contractors throughout the country report that a complete Gibson Ortho installation takes, on the average, only 22 man-minutes per fixture, including stems, lamping and mounting. That's just a fraction of the time required for conventional installations. But speedy installation is only part of the story. Consider the flexibility the owner enjoys. Ortho fixtures can be mounted in continuous rows or at intervals, and re-spaced at any time in a matter of minutes. Two-light fixtures can be replaced with four-light fixtures and vice versa. It's almost as easy as changing an incandescent bulb.

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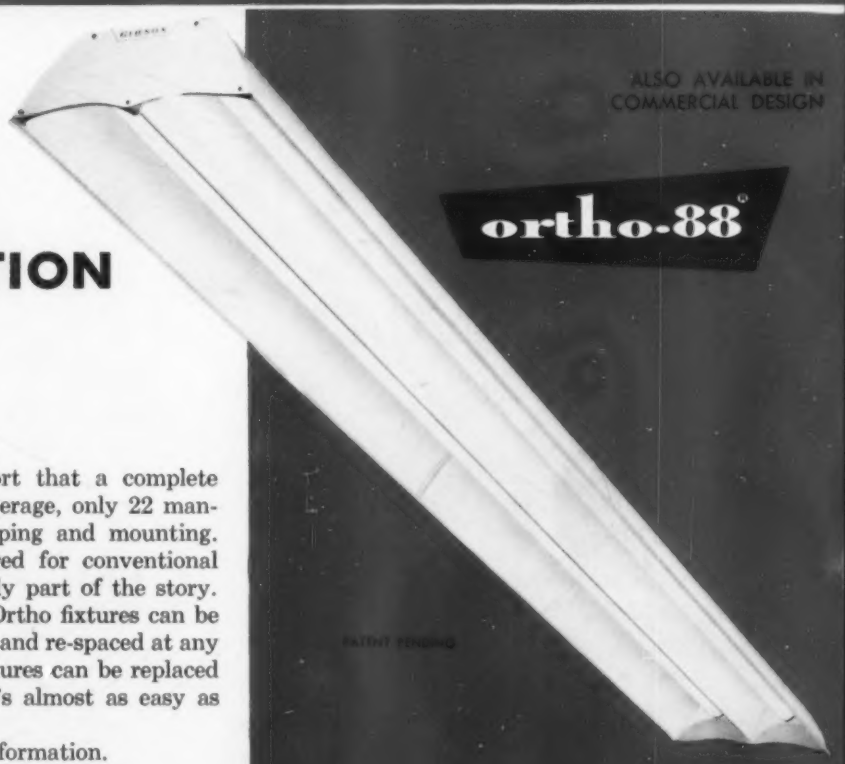

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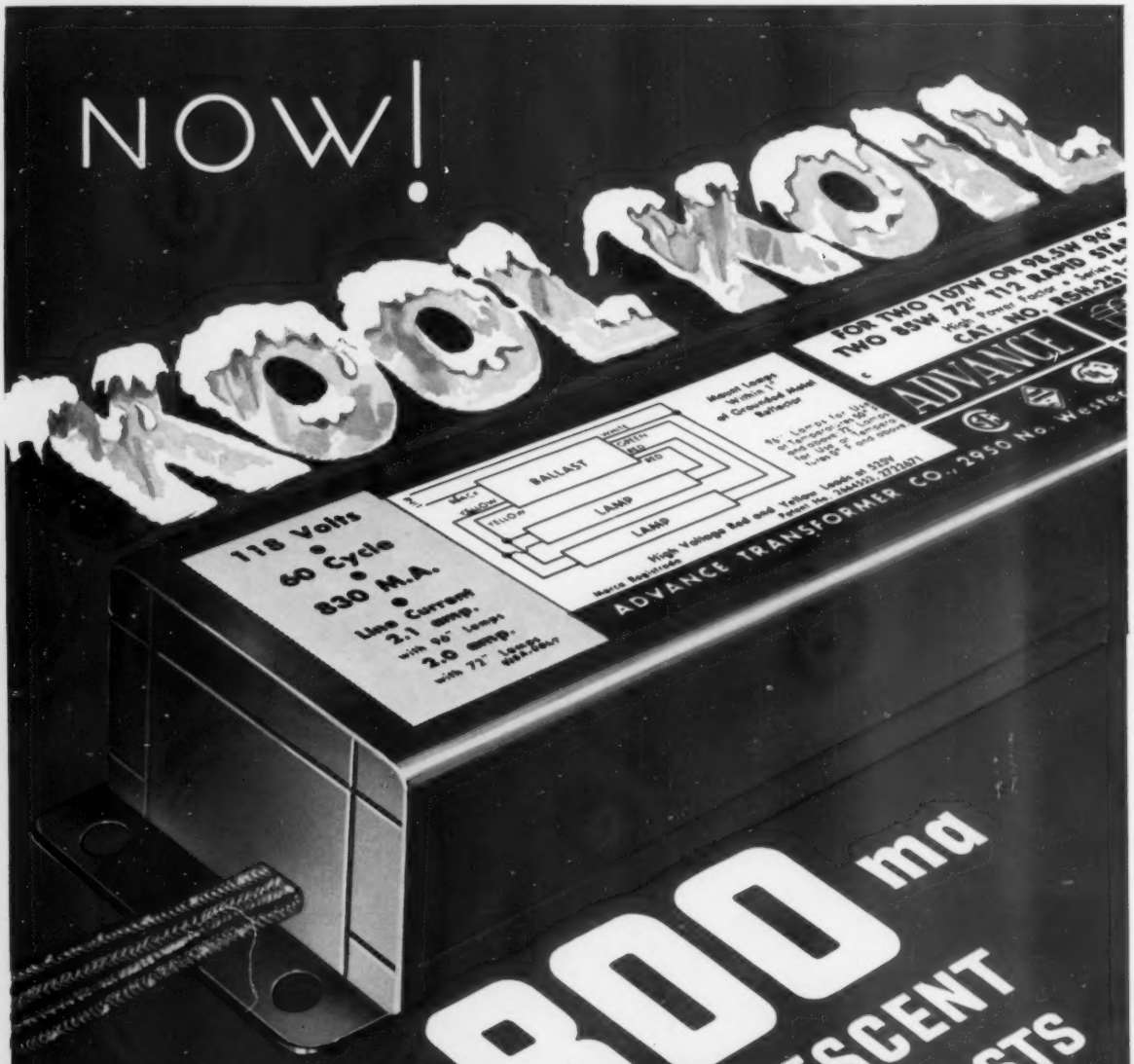

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Volume 38 **Number 10**

Postmaster, Send notices by Form 3579 to 806 Peachtree St., N. E., Atlanta 8, Ga.

• Southwire Galvanized Steel Strand

STRAND SIZE	5/8"	1/2"	7/16"	3/8"	5/16"	9/32"	1/4"	3/16"
WEIGHT PER 1000'	813 lb.	517 lb.	399 lb.	273 lb.	205 lb.	164 lb.	121 lb.	72.9 lb.
MINIMUM BREAKING STRENGTH IN POUNDS								
ASTM A-122-54T								
Galvanized (Single Galv.) Common	11600	7400	5700	4250	3200		1900	1150
Class A (Double Galv.) Common	11600	7400	5700	4250	3200		1900	1150
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Class A (Double Galv.) High Strength	29600	18800	14500	10800	8000	6400	4750	2850
Class A (Double Galv.) Extra High-Strength		26900	20800	15400	11200	8950	6650	3990
Class A Utilities Grade, A.T.&T. and Western Union Spec.—7-wires		25000	18000	11500	6000*	4600		2400**
ASTM A-363-55T (No welds)								
Weldless High-Strength		16800	14500	10800	8000			
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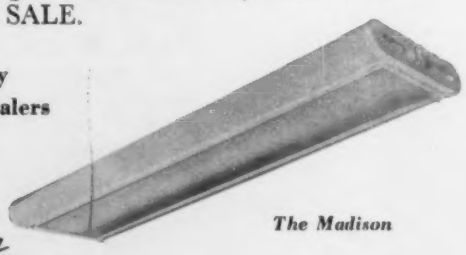

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In this issue

New concepts for illumination levels 34
Recommended lighting levels 36
Creative lighting for added profit 38
Planned lighting maintenance 40
Economy sells high level illumination 41
Lighting system progress 42
Commercial uses for remote control 43
High frequency lighting stretches dollars 44
Good lighting today—better lighting tomorrow 46
Street lighting for the Old South 56
Fashion plate wall switches 58
Maintaining electronic apparatus—Part 2 60

Utility engineering

Narrow base steel towers 74
Bandage applies preservative to poles 77
Automatic reclosing practices 78
Working energized 12 kv lines 82
New utility equipment 86

In every issue

Economic comment 4
Bulletins and catalogs 10
Estimating data sheets 98
Contractors tell how 102
Understanding the code 104
News of the industry 108
Dates ahead 112
News about people 114
New electrical products 115
Reader information coupon 139

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

People's Capitalism

◆ EVER SINCE the close of World War II, there has been a growing emphasis by business writers on a descriptive term about the American economy. This term, People's Capitalism, is used to describe the growing interest in and ownership of corporations by many, many people. In truth, it is almost possible to state that every American is a capitalist in some sense of the word.

Some persons will attack the coinage of the phrase, for to some it sounds too leftist, whereas to others it smacks of the corporate philosophy of the "robber baron" era. A careful analysis of what is meant by the customary users of the term will convince most people that it singularly describes a changing ownership pattern of American industry. And, as such, it can be a vital force for the successful development of American business in the future.

Each year, *Fortune* magazine provides a directory of leading industries, banks, merchandising concerns, foreign companies and so forth. As a part of this survey covering the 500 largest American industrial corporations, a listing is made by companies of the number of stockholders on record. The accompanying tabulation presents the results for the years noted. Thus, the actual holders or owners of corporate shares have shown a steady increase during this period in excess of seven per cent per year.

Year	Total number of stockholders 500 largest corporations	Per cent increase
1954	9,643,762	—
1955	10,334,273	7.1
1956	11,120,904	7.6
1957[1]	11,955,000	7.5

(1) Estimated; not reported in latest Fortune survey of July, 1958.

It should not be assumed that the figures above indicate the total number of American stockholders by any means. There are many more corporations in this country, many with sizeable ownership groups.

In addition, there are the millions of Americans who are stockholders in corporations through indirect means. For example, the individual who holds an insurance policy is indirectly a stockholder in a wide variety of companies. The funds of the insurance company are usually invested in many corporations in order to make the money active as a further income source.

The industrial worker usually has a vital stake in a pension plan or retirement program, the funds of which are administered by a board of trustees. This money is usually invested by the administrators with a view toward increasing the value of the funds on deposit over the years. Whether or not the plan calls for employee contributions, it still represents "his money" and the ownership of the shares in the name of the program is shared by the worker jointly with all other members of his industrial group.

Change in industrial control

Thus, People's Capitalism signifies the growing importance of the financial investment of millions of Americans in business and industry. It has changed the whole concept of industrial control by a few persons of great wealth to one where everybody can have a stake in the economy. With such a direct interest in the welfare of business and industry (as owners), Americans in all walks of life and in most income categories should take a deeper interest in the welfare of the nation's economic enterprises.

The ownership of capital (and through capital the ownership of business enterprise) creates not only security and financial return for the owner, but also should develop a sense of responsibility for the conduct of business affairs. Added knowledge and interest in economic life by millions of stockholders should provide a better climate for industrial growth and development.

It is just this fact that can maintain the eminence of the United States as the most productive and prosperous nation ever on the face of the earth. Moreover, individuals who own capital and recognize their responsibilities are poor targets for an "ism" that might encroach on the American way of life.

Economic signposts

As the 1957-58 recession appears to be giving way to the promised fall and winter upturn, certain factors now loom as important to the economic health. The problem of labor unrest that has been relatively negligible during the deepest part of the recession now is beginning to churn a bit and can have a restricted effect.

The prospects of strikes in the automotive field have been growing with the advent of the new 1959 car models, and labor leaders seem to feel that a strike now would be safer for them than in the past few months. Inasmuch as so many areas of industry are dependent upon automotive production for their health, a general auto strike now (or in the near future) might have drastic effect upon the hoped-for return to good times.

The same situation is evident in various other industries of a durable consumer goods nature. Real economic progress cannot be made until the uncertainties of proposed strikes are passed and all parties in production work together.

Undoubtedly, the elections in November will cause more than a passing problem for business ac-

(Continued on page 60)

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

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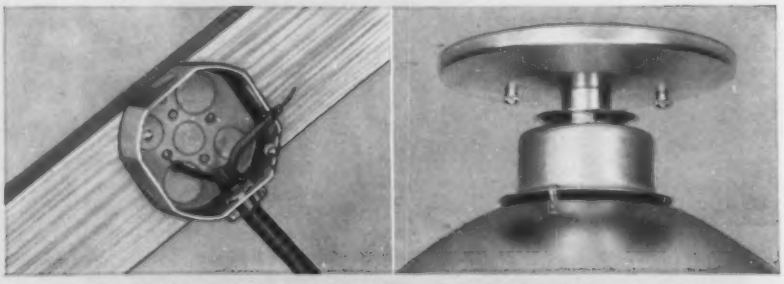

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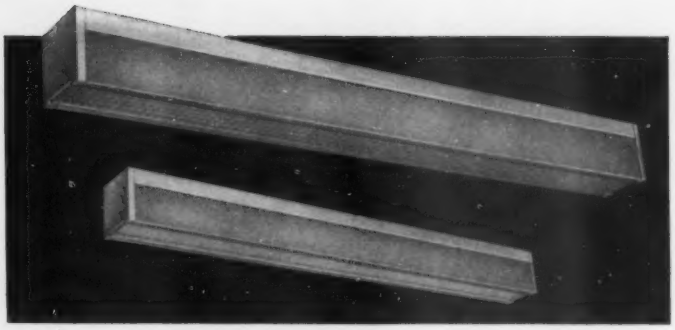

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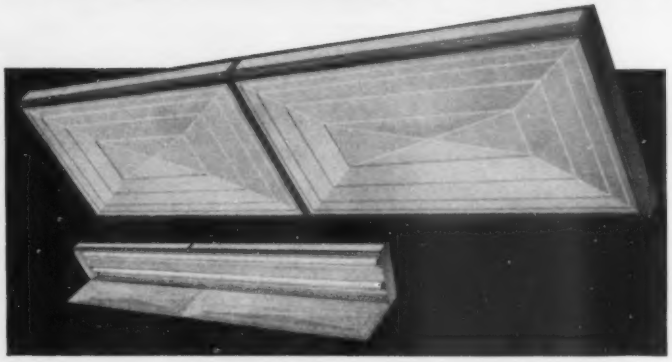
FOR SHOW!

The shallow BOSTON Series makes a neat, clean-cut appearance. Less than 4" deep. Plastic louver or vinyl lens completely framed; hinged at both sides for quick relamping. Rigidly framed plastic sides cannot curl or warp. Available in 4′ or 8′ lengths for 2 or 4 lamps.



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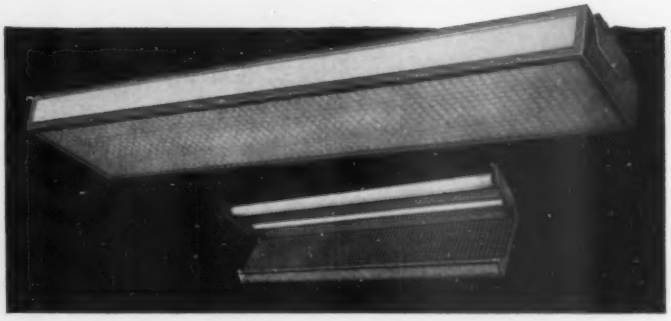

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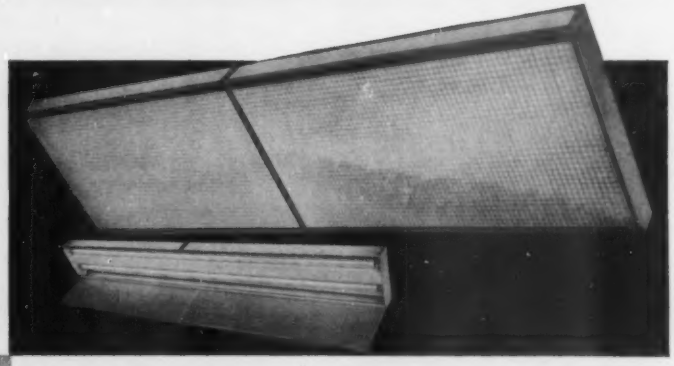

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The new, modern design APPLETON 7P SERIES REELITE with handlamp has the quality features you associate only with APPLETON! Universal mounting bracket . . . beautiful baked hammertone enamel finish . . . hand lamp with shock-proof rubber handle, push-through switch, and snap-open guard: takes 100 watt lamp. The model illustrated (7P2), comes with 28 ft. of 18 gauge 2-conductor neoprene cord. Also available with 25 ft. of 18 gauge, 3-conductor neoprene cord; the extra conductor serving only as a ground.

For ceiling installation, the APPLETON 7P SERIES REELITE has full swivel action to give you light wherever you need it!

Positive stop action holds cord at desired length, yet a flick of the wrist causes the cord to coil neatly and quickly into the reel when the job is done!

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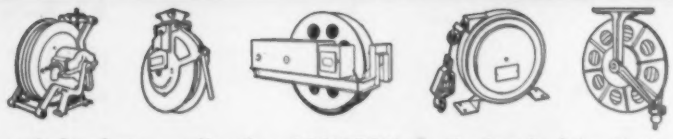

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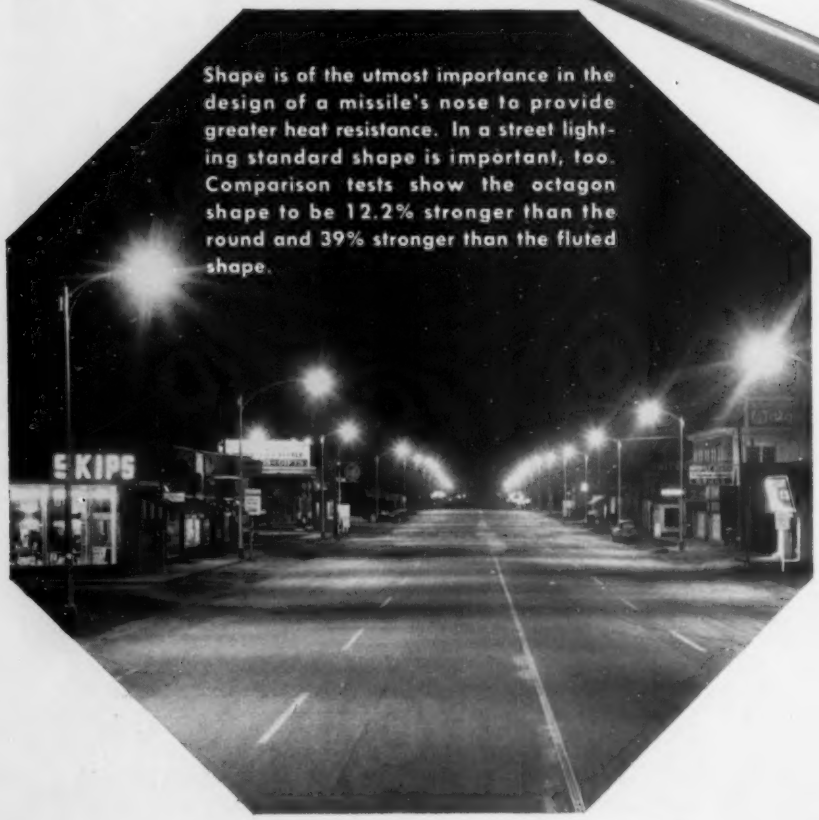
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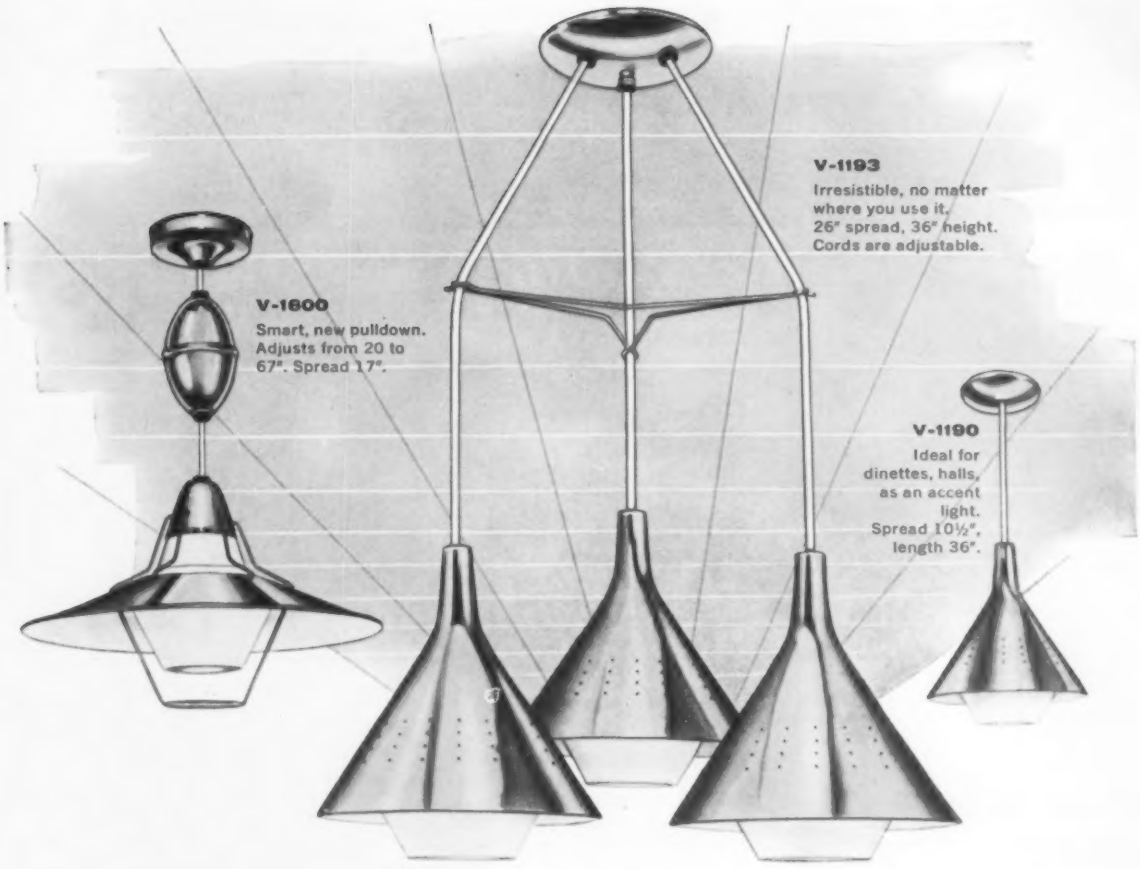
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Irresistible, no matter where you use it. 26" spread, 36" height. Cords are adjustable.
V-1600
Smart, new pulldown. Adjusts from 20 to 67". Spread 17".
V-1190
Ideal for dinettes, halls, as an accent light. Spread 10½", length 36".

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the Sparkle of... GLASS

...to capture her heart and clinch the sale!

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1011—Electrical Conduits

"Natural Electric Conduits" is the title of the 30-page Catalog No. 603 which describes and illustrates the many types of electrical conduits that are manufactured by National Electric Products Corp., 2 Gateway Center, Pittsburgh 22, Pa.

1015—Squeezon Connectors

The Squeezon, a new compression connector for power lines, is fully described in bulletin "SQ" available from the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo. The Squeezon features greatly increased electrical and mechanical efficiency.

1019—Service Panels

Information on protective electrical control centers for homes, apartment buildings, service stations, and industrial applications is contained in Bulletin PM-385, "BullDog Push-matic Electric-Centers," issued by BullDog Electric Products Co., 7610 Jos Campau, Detroit, Mich.

1097—Cord Catalog

A complete 48-page catalog is available from the Cornish Wire Co., 50 Church St., New York 7, N. Y. containing all data on flexible and portable cords, lamp cords, heater cords, cordsets, radio and electronic wires.

1103—Connectors

Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 100-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

1109—Anchoring Devices

An illustrated 32-page catalog, No. 65, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

1135—Wiring Devices

Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc. Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible need and use in Industrial, Commercial and Residential applications.

1197—Convenience Outlets

Bulletin gives complete information on the new P&S No. 500 for adding extra outlets to existing installations. Everything you need in a single package—no steel boxes required. Available from Pass & Seymour, Inc., Dept. ES, Syracuse 9, N. Y.

1209—Fluorescent Ballasts

Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill., has recently completed the compilation and printing of a 20-page catalog on fluorescent ballasts and their use. Included are data sheets on available Advance ballasts and a comprehensive installation and operation section and testing procedures. Copies of the booklet are available on request.

1211—Fluorescent Fixtures

Catalog folder No. 911, "Peerlite by Guth," has been announced by the Edwin F. Guth Co., 2615 Washington Blvd., St. Louis 3, Mo. Copies of this new eight-page booklet are available from the company upon request. The booklet is designed for the lighting specialist, giving complete engineering data and dimensions.

ELECTRICAL SOUTH
806 Peachtree St., NE
Atlanta 8, Ga.

October, 1958

Gentlemen:

Please send me the bulletins and catalogs indicated.

(Print Plainly)

Name _____ **Title** _____

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Circle numbers below. Bulletins and catalogs will be mailed promptly.

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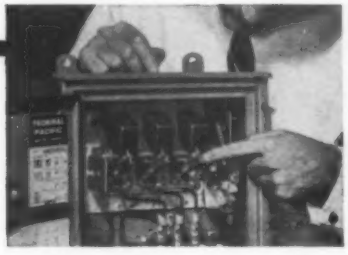
1237	1245	1251	1253	1257
1259	1261	1263	1265	1267
1269	1273	1275	1277	1279
1281				

Before you buy Motor Controls... CONSIDER THESE FEATURES!

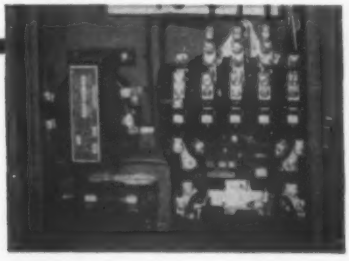
SUPERIOR ENCLOSURE CONSTRUCTION

Welded seams...sturdy piano hinge...slotted Hex cover retaining screws...cast aluminum handle...padlock provisions on handle *and* door...oil resistant neoprene gasket...mechanical cover interlock...rust-proof finish.



COOLER, SAFER SWITCHES

Visible blades...crossbar *under the blades*...deionizing arc quenchers...dual switchblade construction...only 2 joints per pole...pressure-type solderless lugs.



INLINE SOLENOID STARTERS

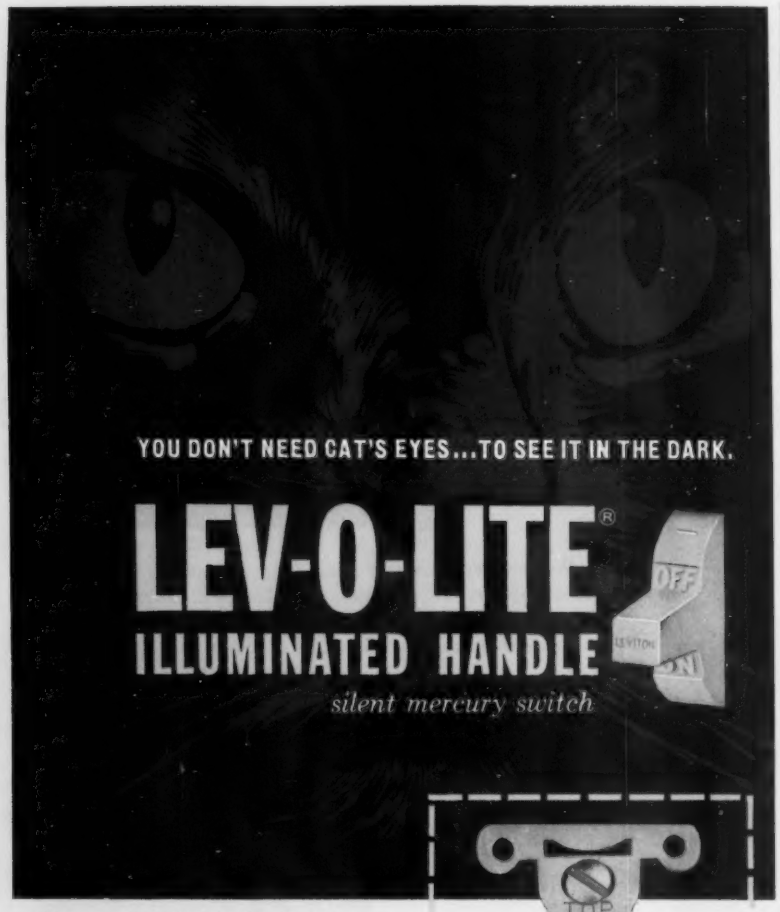
Easy-to-change, silver cadmium contacts...contact assembly rides on ball bearings...operating coil easily accessible...flexible coil leads...bi-metallic overload relay for manual or automatic resetting.

FEDERAL PACIFIC'S TYPE "K", NEMA XII COMBINATION MOTOR STARTER

Designed for mass production industrial equipment, the quality features found in the Type "K" are typical of the kind of construction that goes into every device in the Federal Pacific line. Federal Pacific's manual or magnetic motor controls are available in NEMA sizes 0 through 5—with accessories to meet all practical requirements. Bulletin 514 gives full details on combination starters. For this or for specific information to cover your particular needs, write to: FEDERAL PACIFIC ELECTRIC COMPANY, General Offices: Newark, New Jersey.

FEDERAL FPE PACIFIC

The Best in Electrical Distribution and Control Equipment



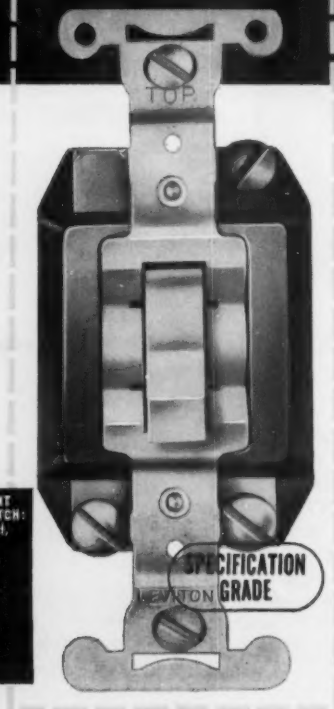
No more fumbling in the dark . . . no more dirty walls from "switch-groping." Instead, a tiny, built-into-the-handle neon lamp that always remains bright, lasts a lifetime, and costs but a few cents a year to operate! This switch is sturdy, easy-to-install, with no moving parts to wear out, no springs to snap. Ideal wherever silence is essential . . . now popularly priced for every installation.

And . . . it's just one of the many fine, economical devices made available to everyone through the superior skills and complete resources of LEVITON!

For the complete story, write today on your letterhead.

All silent switches listed by U. L. and C. S. A.

LEVITON SILENT MERCURY SWITCH: Fully enclosed, rated 10A.-125V.I., 5A.-250V. Ivory toggle, with illumination. Single Pole No. 5561 or Three Way No. 5563



Available boxed or carded. Specify "K" when ordering on card.

Your best jobs are done with . . .

LEVITON MANUFACTURING CO., INC., BROOKLYN 22, N.Y.

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LEVITON

For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORPORATION

Enter Code Numbers of Catalogs Desired on Coupon on page 10.

1219—Electrical Enclosures

Catalog No. 5354-U is a compact 94-page catalog describing the complete line of steel and aluminum electrical enclosures manufactured for utility use by the B & C Metal Stamping Co., 590 Means St., N. W., Atlanta, Ga. The catalog is well illustrated and contains complete specifications as well as prices on all items in the B & C line.

1223—Circuit Protection

A 24-page illustrated handbook contains suggestions for selecting the right kind of protection for electric circuits, motors, appliances and apparatus. Includes motor wiring diagrams and a complete list showing proper size fuses to use. Available from Bussman Mfg. Co., University at Jefferson, St. Louis 7, Mo.

1227—Conduit Fittings

A new complete 24-page catalog illustrating their complete line of conduit fittings and lighting parts for the electrical wholesaler has been made available by Elliott Electric Products Co., 1513 Olmstead Ave., New York 62, N. Y.

1229—Switch and Outlet Boxes

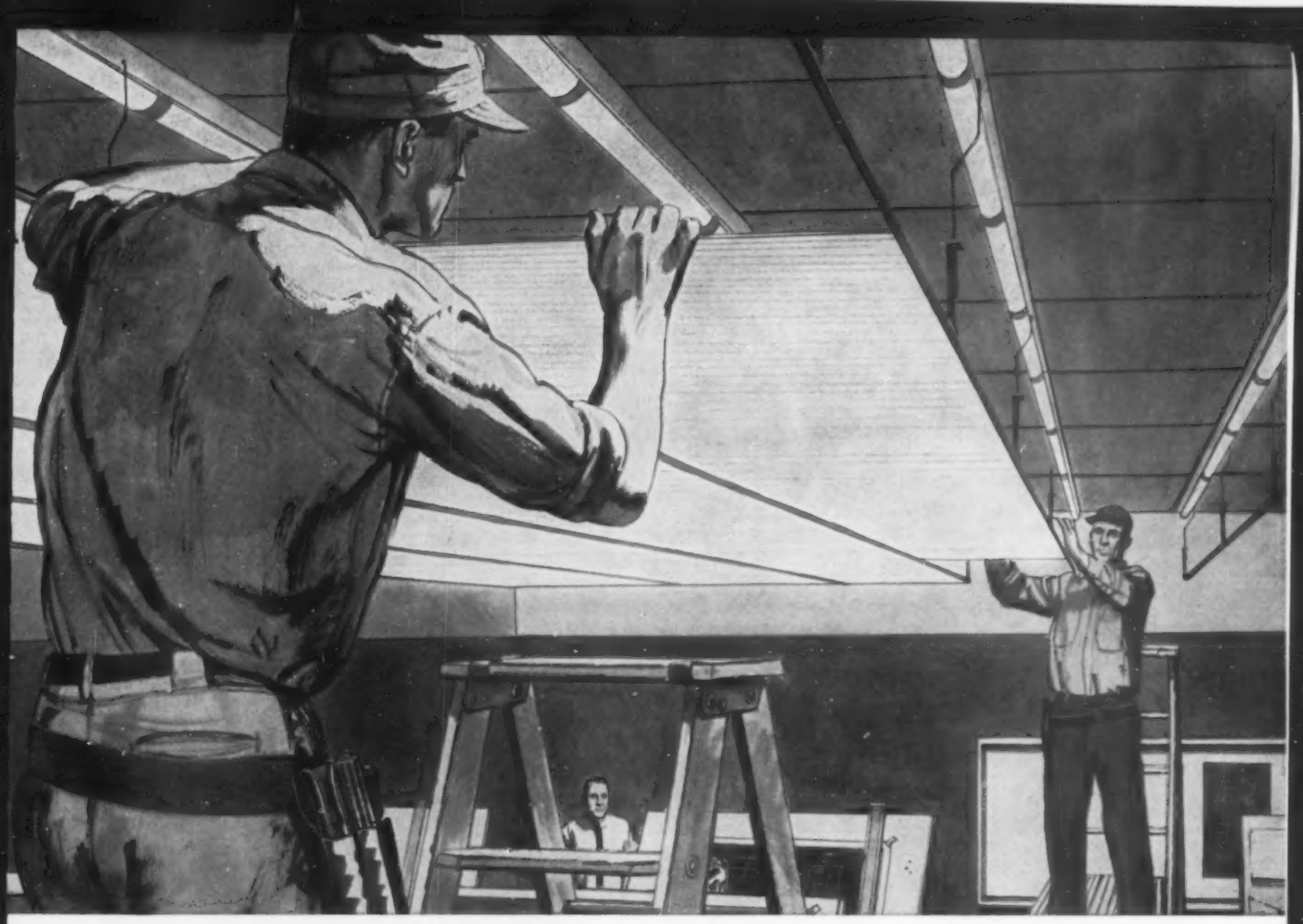
A new RACO General Catalog is now available listing detailed information on boxes, covers, and bar hangers. The catalog includes data on numbers of wires permitted per box and a list of comparative catalog numbers. Copy available from All-Steel Equipment, Inc., Aurora, Ill.

1233—Troffer Catalog

A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applications.

1237—Wireholders

Knox Porcelain Corporation, Knoxville 1, Tenn. has recently redesigned a one-piece metal base style reinforced wireholder, No. 5009. Base and screw are hot dipped galvanized. This wireholder has extra sharp threads and quick starting point to make driving easy. KNOX manufacturers a complete line of Porcelain Wireholders, House Brackets, Service Entrance Mast Kits and Accessories and other Secondary Service Materials.



Fine craftsmanship and better production stem from easy seeing and uniform illumination. Here is an important project on which Graybar, located in over 130 principal cities, can give you or your customers real help.

Your best source of EVERYTHING IN LIGHTING ...is Graybar

Whenever you or your customers are confronted with the need for better lighting in any plant, office or warehouse area, talk with a Graybar lighting expert. For, whatever the requirements, he can give an impartial recommendation for the best lighting system for the need—from the most complete selection of lamps and lighting units available from any one source!

The Wakefield "Magic Ceiling," illustrated above, is an example. Units arrive on the job as a complete package: fluorescent strip lighting, straps, channels, grid and diffusers. No preliminary construction is required and the Magic Ceiling can be installed practically overnight.

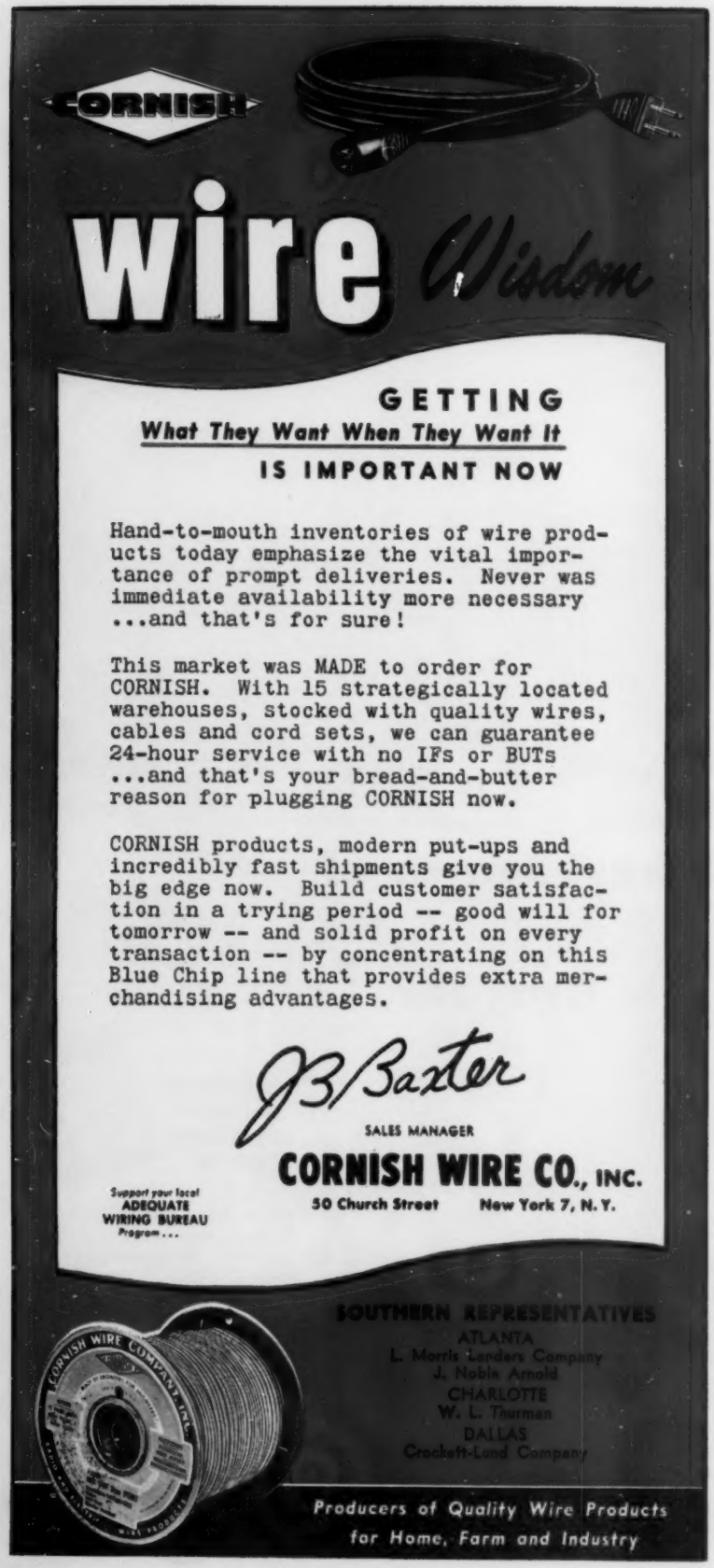
New lighting developments such as this are constantly being announced by the manufacturers of America's best illumination equipment whom Graybar represents. Some of these are: Benjamin, Curtis, Day Brite, Pittsburgh, Silvray, Smithcraft, Wakefield, Wheeler, and Wilson. You and your customers have direct access to this current progress in lamps and lighting equipment when you work with the nearest Graybar office. 696-711

Write Graybar for your copy of "NEW INTERIORS FOR OLD"

which shows striking transformations made within a few hours by installing the "Magic Ceiling." This new lighting source comes in stock units to fit interiors of all sizes and shapes.

CALL GraybaR **FIRST FOR** Everything Electrical GraybaR ELECTRIC COMPANY

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES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GETTING
What They Want When They Want It
IS IMPORTANT NOW
Hand-to-mouth inventories of wire products today emphasize the vital importance of prompt deliveries. Never was immediate availability more necessary ...and that's for sure!
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Crockett-Land Company
Producers of Quality Wire Products for Home, Farm and Industry

Enter Code Numbers of Catalogs Desired on Coupon on page 10.

1253—Power Connectors

A completely new catalog (No. 526) of power connectors and bus support clamps is now available from Southern States Equipment Corp., Hampton, Ga., superseding catalog No. 525-R. Furnished in a handsome 7-ring binder, the new catalog includes sections on bus support clamps, couplers and angle braces, bar connectors, Tee connectors, stud connectors, ground connectors, parallel clamps, and terminals.

1257—Centrifugal Roof Ventilators

An 8-page, two-color folder (SDA-220) giving construction features, performance data, dicensions and recommended specifications for the new Centrifugal Roof Ventilator manufactured by The Peerless Electric Company, Warren, Ohio. Other important Peerless Fan and Blower products and a lis of Peerless sales representatives are also included.

1259—Electrical Tapes

Twelve pages of specifications and application data make up an ottractive booklet on Dutch Brand Electrical Tapes. Plastic, friction, and rubber tapes, as well as a vinyl tape made in nine different colors, are available from Dutch Brand Division, Johns-Manville, 7800 So. Woodlawn Ave., Chicago 19, Ill.

1261—Cable Puller

The electrically powered cable puller manufactured by The Barth Corp., 12650 Brookpart Rd., Cleveland 30, Ohio, is described in a new booklet. This tool is ideal for industrial and commercial construction and maintenance.

1263—Conduit Fittings

Bridgeport Fittings, Inc., 209 Center St., Bridgeport, Conn., offers a twenty-six page catalog describing their line of conduit, bushings, lock nuts, couplings, nipples, supports, connectors, and other fittings. Size, weight, and packaging details are included.

1265—Wire and Cable

Simplex Wire & Cable Co. announces a new catalogue of the family of ANHYDREX insulated cables. Catalogue No. 1028, which supersedes Nos. 1017 and 1018, is available on request from Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

POINT THE WAY

with NEW, PROJECTED LETTER

FLUORESCENT EXIT UNITS by PERFECLITE

SURFACE TYPE UNIT

Check These Superior Features:

Phosphorescent Lucite panel gives ½ hour after-glow should the circuit become dead. 6" projected letters. Available in models for all surface type as well as recessed installations. Mounted from top, back, side or from a pendant. Surface models are also available for either single or double face use. Pivot hinged, die formed 20 ga. steel frames for easy servicing. Surface type boxes are made of 18 ga. press drawn steel, ½" KO's top and side. Recessed boxes are of 20 ga. press drawn steel, six ½" KO's.

Lucite faces available in 4 color combinations — with or without arrows. Completely wired for two T-5 6-watt lamps, 118-V. AC ballasts. Also available for use in 277-V. systems.

You reduce installation costs, make every building safer when you select Perfeclite unbreakable projected letter fluorescent exit signs. For further information, mail the attached coupon today!

PERFECLITE PRODUCTS — THE MARK OF LIGHTING SERVICE

Units are Underwriters' Laboratories, Inc., approved, and comply with National Electrical Code.

THE PERFECLITE COMPANY

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Please send me the Perfeclite Data Folder EX-58 C.

NAME _____

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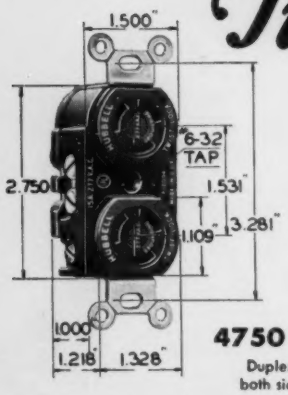
the first and only

GROUNDING

Twist-Lock® for...



15 amp 277 volt

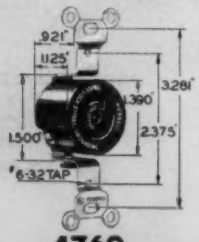
Fluorescent Lighting Circuits

Presenting . . . the first and only 277 volt duplex receptacle on the market that combines positive grounding plus positive locking. Feeds two fluorescent fixtures from one single gang box.

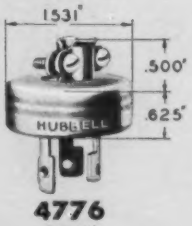
4750 DUPLEX RECEPTACLE
Duplex receptacles are both side and back wired

A Complete Line of Receptacles and Caps

4751
Duplex Receptacle with 4" cover



4760
Single Receptacle



4776
Armored Cap

15 amperes, 277 volts only

(for complete listing, write for new catalog page)

Non-interchangeable with regular "Twist-Lock", 4700 line grounding (15A.-125V.) "Twist-Lock", or any other device on the market.

Specifically designed for 277 volt circuits.

Listed by Underwriters' Laboratories, Inc.

Offers tremendous savings in fixture installation time and money.

Another Hubbell exclusive.

HARVEY HUBBELL, INC.

HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS

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103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

IN CANADA:
Scarborough, Ontario,
1160 Birchmount Road

Enter Code Numbers of Catalogs Desired on Coupon on page 10.

1267—Guy Strand

An Engineering Data Sheet—E. D. 1878—describing the new Copperweld Type M Guy Strand. Contains table of physical properties as well as instructions for dead-ending this new high-strength, non-rusting guy strand. Available from Copperweld Steel Company, Frick Building, Pittsburgh 19, Pa.

1269—Hydraulic Power

A new bulletin describing the two-speed, fast-approach portable power for hydraulic tools obtainable from hydraulic power pumps is offered by Greenlee Tool Co., of Rockford, Ill.

1273—Ventilators and Range Hoods

The Ventrola Mfg. Co., Owosso, Michigan, has available a new 12 page catalog describing in detail their entire line of Ventilators (both kitchen and bathroom) and Push-button range hoods. Installation instruction sheets of all models are also available.

1275—Wiring Devices

A complete new catalog of wiring devices is now available from Bell Electric Co., 5735 S. Claremont Ave., Chicago 36, Ill. The line includes a wide range of weatherproof receptacles and switches, portable garden lights, wall plates, and specialty items.

1277—Lighting Fixtures

A new completely detailed Catalog showing the latest in Indoor and Outdoor Lighting and Luminous Ceilings available from STA-BRITE FLUORESCENT MFG. COMPANY, Box 291, Riverside Sta., Miami, Fla.

1279—Lighting Fixtures

An illustrated 44-page price list is now available from EJS Lighting Corp., 921 East Pico Blvd., Los Angeles 21, Calif. In convenient condensed form, this price book includes a sketch of each fixture as well as catalog number, number of lights, recommended wattage, description, standard package quantity, weight, list price and dimensional data.

1281—Electrical Fittings

A wide range of lug, terminals, connectors and other wire and cable fittings are described in a new catalog available from H. B. Sherman Mfg. Co., Battle Creek, Mich. Complete dimensional data, packaging information, etc., are included.

progress

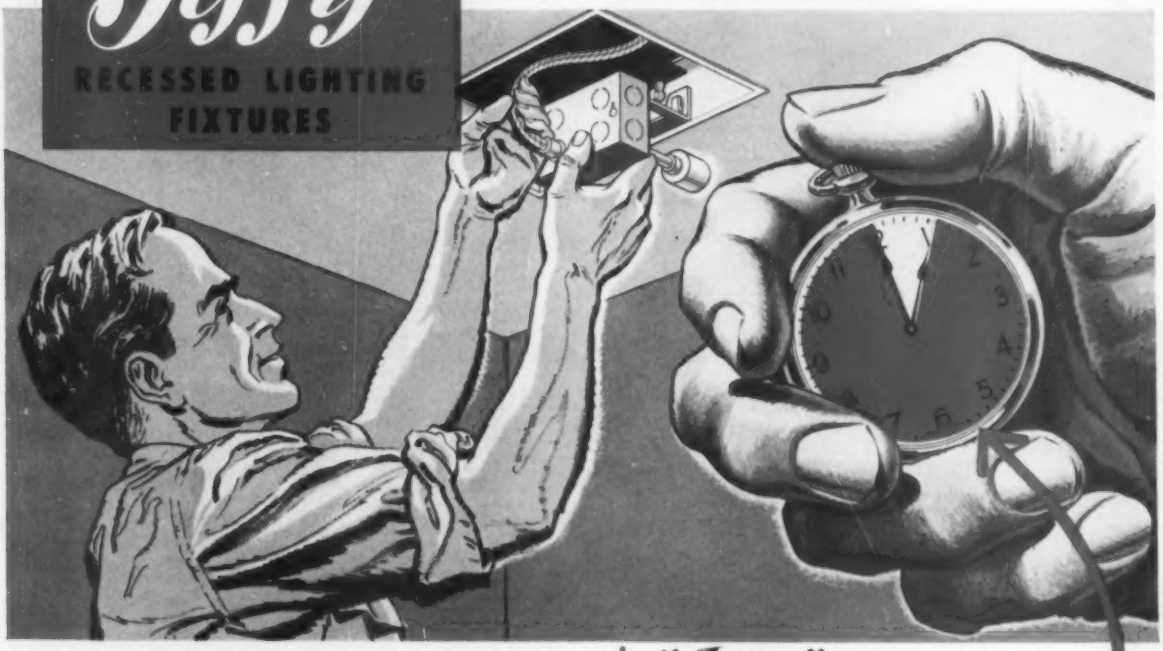
"Jiffy"

RECESSED LIGHTING FIXTURES

revolutionary!

cuts installation time by 2/3

no tools needed!

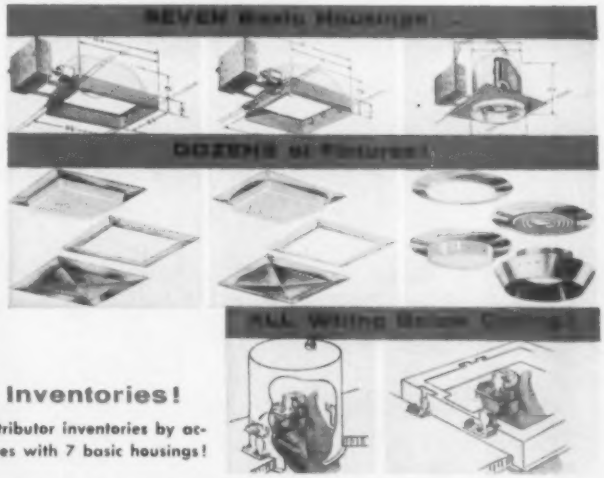


average recessed fixture installation time: 15 MINUTES!

"Jiffy" installation time: under 6 MINUTES!

PROGRESS clocked electricians at work . . . found revolutionary new "JIFFY" fixtures take ⅓ the time to install—because all wiring is below ceiling, no tools are required! "JIFFY" is an amazing advance in recessed fixture design with these quality features:

- "FLIP-TOP" HINGED JUNCTION BOX . . . wired below ceiling
- "THUMB-LOK" CLAMPS . . . eliminate carpentry
- LEVELIZER SOCKET for instant alignment
- CONCEALED TRAXION HINGING
- OPTICALLY DESIGNED PARABOLIC REFLECTORS
- SWING-OUT REFLECTORS
- ALL TYPES OF FINISHES



Cuts Down Inventories!

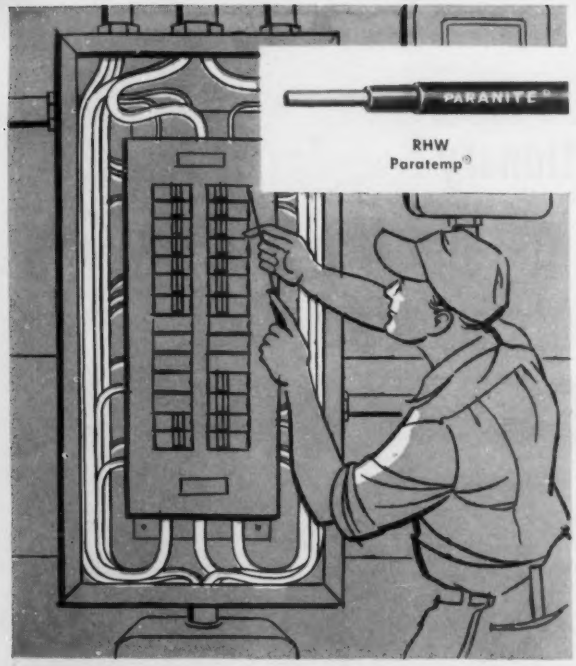
"JIFFY" cuts down distributor inventories by accommodating all fixtures with 7 basic housings!

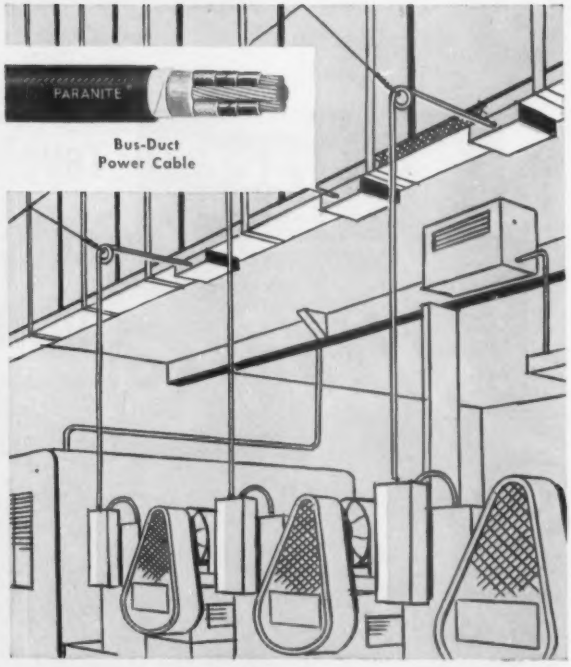
Get the amazing facts on "JIFFY" today! Write:

PROGRESS Manufacturing Company, Inc.

Philadelphia 34, Pa.

Covered by Patent Numbers 2,840,691; 2,561,986; 2,684,220—Other Patents Pending.





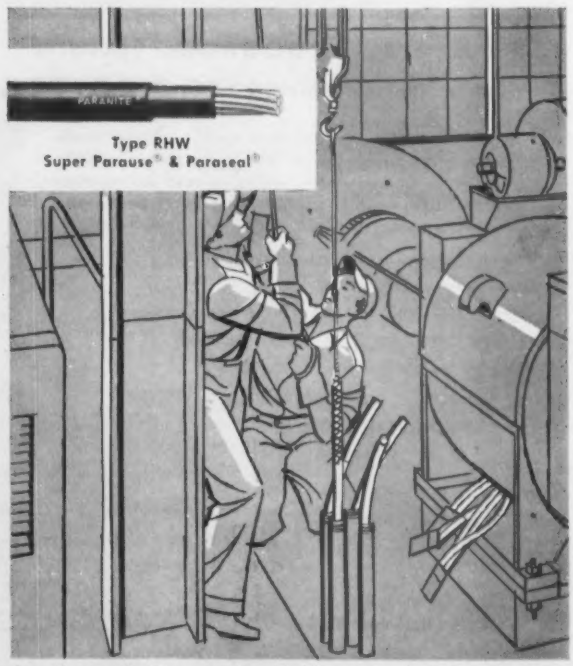
From Source to Service with PARANITE®

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation

FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Alabama; Anaheim, California; Jamesboro, Indiana; Marion, Indiana; Tiffin, Ohio



Sales Offices in all Principal Cities . . . Sold only through Recognized Electrical Distributors

From out of tomorrow a revolution in Light Contemporary Space Ellipse Series

a dramatic new shape premiered by EJS at the National Lighting Exposition. The first successful all-glass ellipse fixture in the lighting industry; bold, beautiful, exciting. Light radiates from the entire surface of a gracefully formed opal glass ellipse with its *greatest intensity downward*, emanating along the large elliptical lower surface. Here, at last, is a lighting fixture that gives near perfect light distribution. Yes, the Contemporary Space Ellipse Series is lighting design at its beautiful best... ideal for a wide variety of commercial and residential applications.

#18-300 1-light rigid stem ceiling fixture wired for 300 watt bulb/18" diameter glass ellipse/standard stem length 18". Stem lengths to fit all specifications.

THE SMART LOOK IN LIGHT IS EJS

...a style, size and finish for your every requirement

PHONE, WRITE, WIRE FOR PREVIEW SAMPLE SHIPMENT AND ILLUSTRATED LITERATURE.

EJS LIGHTING CORPORATION

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CENTRAL SALES AGENCY, 2717 Menlo Drive, Wichita 16, Kansas, MUrray 3-8215: OKLAHOMA • MISSOURI • KANSAS — W. N. KENNON COMPANY, 7 Camden Road, N. E., Atlanta 9, Georgia, TRinity 4-5566: GEORGIA • ALABAMA • MISSISSIPPI — ORLICK-KOLMAISTER, 3030 Josephine Street, New Orleans 25, Louisiana, JAckson 5-7934: FLORIDA • LOUISIANA • TEXAS — JAMES I. SCHWARZ, 4137 Pine View Road, Charlotte 7, North Carolina, EMerson 6-1147: NORTH CAROLINA • SOUTH CAROLINA • TENNESSEE — UNION MADE BY I. B. E. W. U. L. APPROVED

up, UP again!

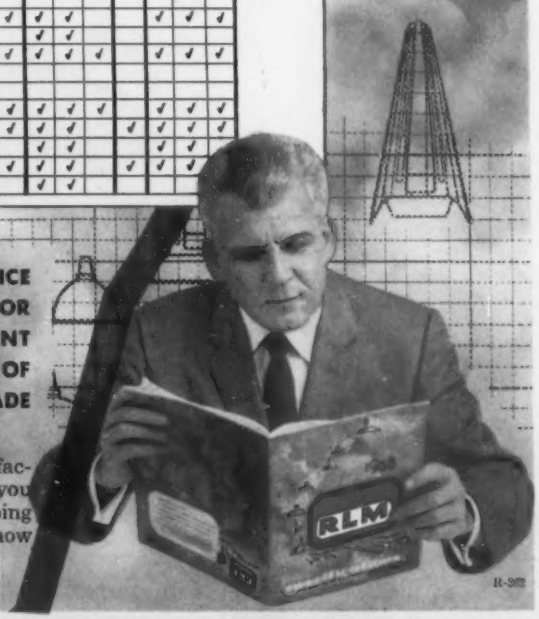
goes the value of the RLM LABEL on all these lighting units made by these leading manufacturers

This label identifies the RLM-certified lighting equipment of 27 leading manufacturers.

INCANDESCENT RLM SPECIFICATIONS							FLUORESCENT RLM SPECIFICATIONS										
							8-15% UPLIGHT							20-30% UPLIGHT			
#1	#2	#3	#4	#18	#40		D-1	D-1	D-1	D-2	D-2	D-2	D-3	SD-1	SD-1	SD-1	
100-1000w Dome	100-1000w Deep Bowl	100-1000w Syn. Angle	500 & 1000w High Bay	200-1000w Glassteel Diffuser	500 & 1000w High Bay*		2-40w 1A-1B	2-75w 1D	2-800 ma. 1E	3-40w 2A-2B	3-75w 2D	3-800 ma. 2E	2-90 & 60w 3A-3B	2-40w 1A-1B	2-75w 1D	2-800 ma. 1E	
5			1		1	ABOLITE LIGHTING DIV.											
3	3	3		1		APPLETON ELECTRIC CO.											
5	4	4		1		BENJAMIN ELECTRIC MFG. CO.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
						DAY-BRITE LIGHTING, INC.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
						EASTERN FIXTURE CO., INC.	✓	✓		✓							
4	4					ELECTRO LIGHTING CORP.	✓	✓					✓	✓			
						ENDER-MONARCH CORP.	✓	✓		✓							
						FLUORESCENT FIXTURES OF CALIFORNIA	✓	✓	✓	✓	✓	✓		✓	✓		
						GLOBE LIGHTING PRODUCTS, INC.	✓	✓		✓	✓				✓		
						THE EDWIN F. GUTH CO.	✓										
						KEYSTONE ELECTRIC MFG. CO.	✓	✓		✓	✓						
						LIGHTING DYNAMICS, INC.	✓	✓		✓	✓			✓	✓		
4			2			THE MILLER CO.	✓	✓	✓	✓	✓		✓	✓	✓	✓	
						MITCHELL LIGHTING DIV.		✓		✓	✓						
4			2		1	MULTI ELECTRIC MFG., INC.	✓										
4	3	3				OVERBAGH & AYRES MFG. CO.											
5	3	3		2		QUADRANGLE MFG. CO.											
						RUBY-PHILITE CORP.	✓	✓	✓	✓	✓			✓	✓	✓	
						SMITHCRAFT LIGHTING DIV.	✓	✓		✓	✓						
5	3	3				SMOOT-HOLMAN CO.	✓	✓	✓	✓	✓	✓		✓	✓	✓	
4	1		1		1	THE SPERO ELECTRIC CO.											
4		2				THE STEBER MFG. CO.											
						SUNBEAM LIGHTING CO.	✓	✓	✓	✓	✓	✓		✓	✓	✓	
						SYLVANIA ELECTRIC PRODUCTS, INC.	✓	✓	✓	✓	✓		✓	✓	✓	✓	
5	4	2		2		WESTINGHOUSE ELECTRIC CORP.	✓	✓		✓	✓			✓	✓		
5	4	2				WHEELER REFLECTOR CO.	✓	✓	✓	✓	✓		✓	✓	✓		
						WORK-O-LITE CO.	✓	✓		✓	✓						

*Aluminum Reflectors all others are Porcelain Enamel

Note: Many manufacturers make incandescent RLM Units for more than one lamp size. The numerals refer to the number of different-size RLM Units which the manufacturer offers under the specification.



RLM ADDS NEW SPECIFICATIONS FOR SPECIAL SERVICE FLUORESCENTS.....REVISED SPECS COVER UNITS FOR 800 ma. LAMPS.....BROADENED INCANDESCENT STANDARDS FOR REFLECTOR SIZES AND TYPES OF LAMPS.....EVERY RLM SPEC STRENGTHENED, MADE MORE IMPORTANT, REVISED UP!

These are some of the reasons why the leading manufacturers listed above are especially proud today, to bring you units bearing the RLM Label. They know that, by keeping pace with latest industrial lighting advancements, RLM now stands for more lighting quality than ever.

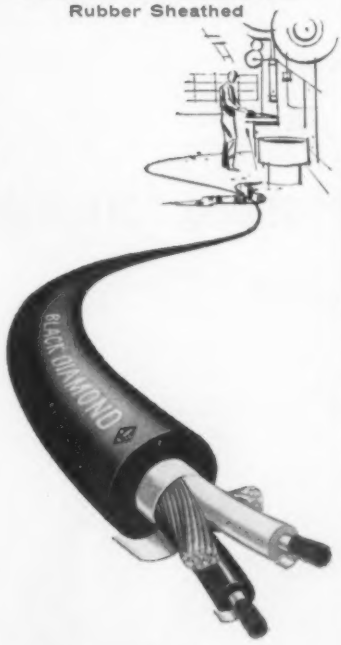
Send for Free 1958 RLM Specifications Book. Write: RLM Standards Institute, Suite 8280, 326 W. Madison St., Chicago 6, Ill.

Diamond has all 3 portable cords

Red-D-Prene®
Neoprene Sheathed

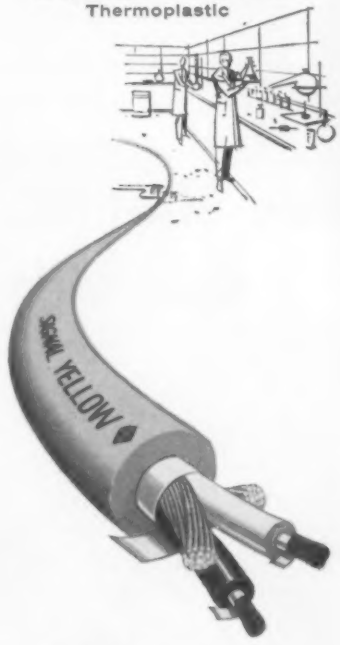
for hot, oily locations

Black Diamond
Rubber Sheathed



for general purpose use

Signal Yellow
Thermoplastic



for all locations where heat is no problem

Red-D-Prene for mill and plant use is designed with tough, oil, heat and flame resistant Type MD (Mill Duty) neoprene jacket in industrial red for ready identification.

Black Diamond has durable rubber jacket protecting against alkalies, acids and moisture. Very flexible construction prevents kinking in service.

Signal Yellow has a jacket of yellow thermoplastic that is quickly seen . . . clean to handle . . . smooth sheath will not readily collect dirt. Easy to pull.

ORDER FROM DIAMOND TODAY!

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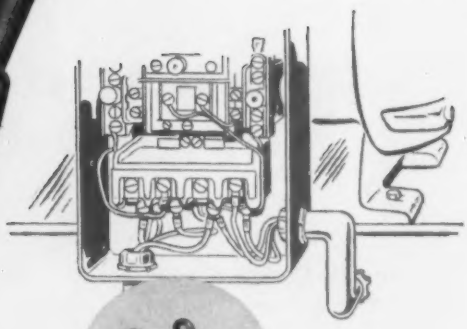
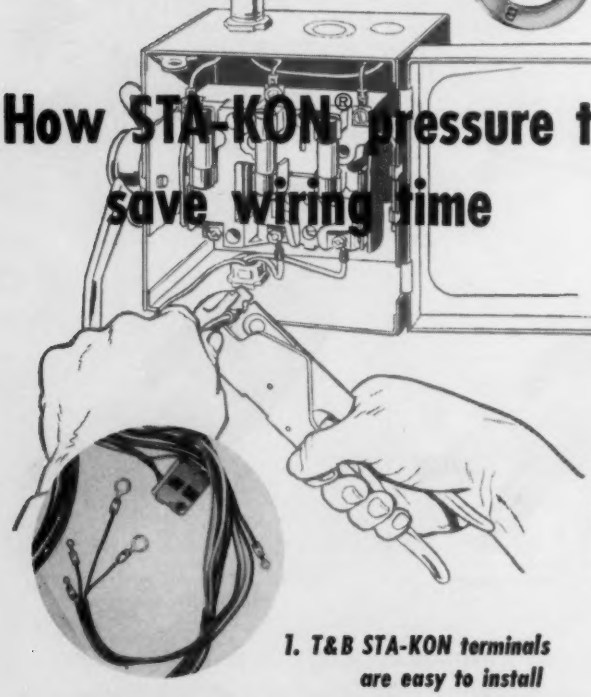
DIAMOND
WIRE and **CABLE** Company
Sycamore, Illinois
WAREHOUSE: BIRMINGHAM, ALABAMA



2 . . . in cramped locations

How STA-KON® pressure terminals save wiring time

STA-KON *Junior* Terminals are specially designed for fast hookups in confined areas, particularly on small blocks or where there is close spacing between barriers. Terminals are one-piece copper alloy with overall dimensions at a minimum. STA-KON Junior Terminals far exceed UL requirements for strength and conductivity. Both slotted and ring types available.



3 . . . or on product assembly lines

1. T&B STA-KON terminals are easy to install

Just one simple operation with a T & B SHURE STAKE® hand tool or production line tool and the job is done. Terminal and wire, either solid or stranded, are staked, under terrific pressure, to a near solid mass — all in a matter of seconds. Terminal barrel never relaxes its grip. Foolproof tool operation prevents improper installation — connections won't vibrate loose . . . can't fail under severe stresses.

Portable or bench-mounted, air or foot-operated tools are available for high-speed production line work. All designed for a minimum of operator fatigue. No flame, heat or fluxing required to install T & B STA-KON Terminals.

Complete lines available in varied tongue styles and stud sizes with and without insulation grip. Wire sizes 22 to 4/0. Write for Bulletin 61.

LOOK FOR THIS SIGN —

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

THE THOMAS & BETTS CO.

INCORPORATED

36 Butler Street • Elizabeth 1, New Jersey

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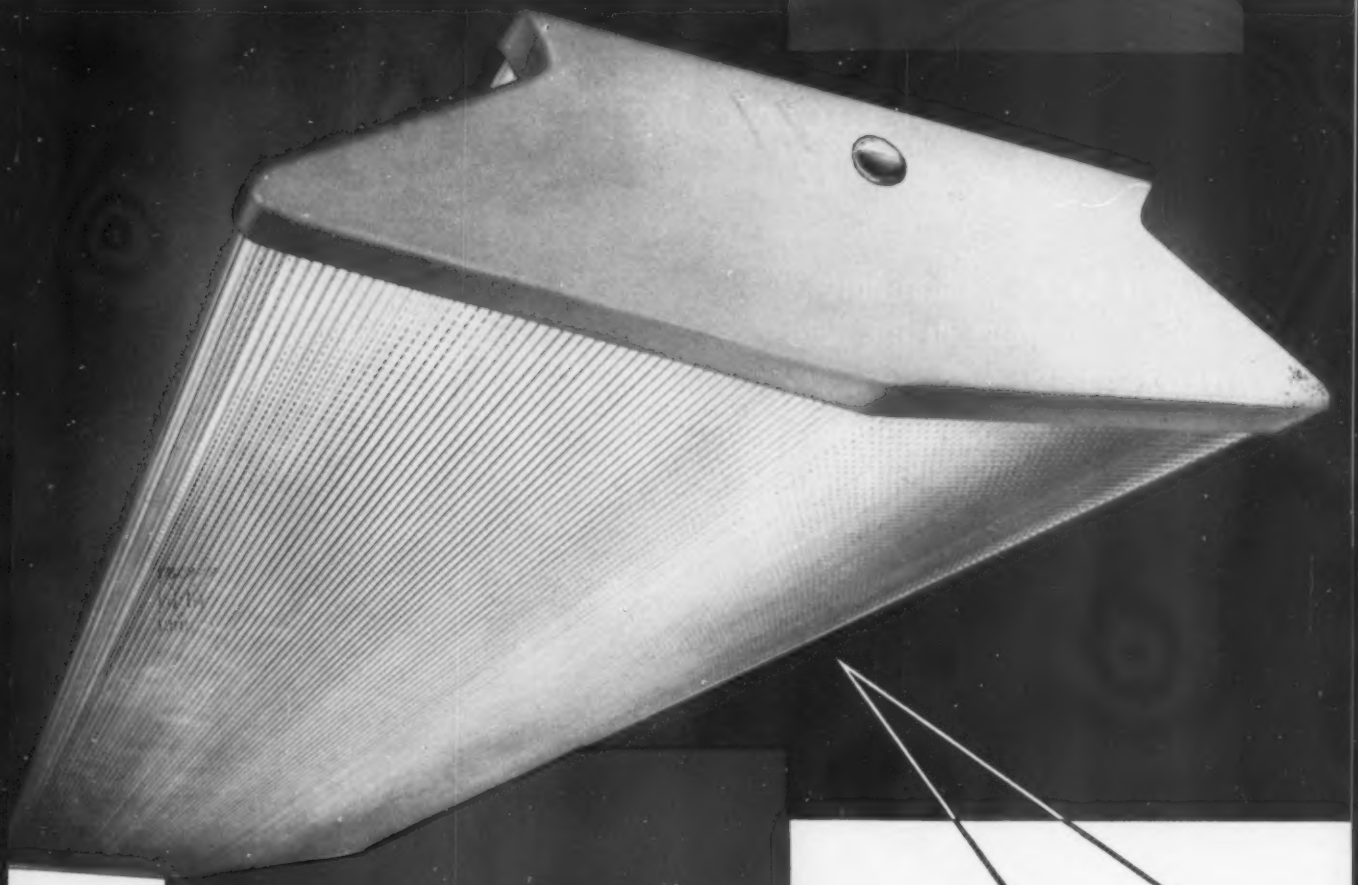
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

More Fluorescent Lighting Jobs at *Full* Profit . . .

SABRE by miller



When you select and install the new SABRE by Miller you're able to get a bigger share of store, office, and school lighting jobs at *full* profit. Because with Sabre you're offering a fixture that's *really different* . . . that has distinctive styling and outstanding performance . . . is quickly and easily installed, and is *competitively priced.*

And, your customers will like and benefit from Sabre's unique and exciting features, such as: the sweeping lines and shallow depth of "Flite-Line" Styling which enhance the appearance of any interior . . . the one-piece wrap-around reflector of prismatic crystal-clear plastic which provides extra "sparkle" and comfort, and is easily removed for relamping and cleaning. And, of course, *they'll* find Sabre's modest price attractive, too!

So ask your *Miller Distributor* to show you this exciting new fixture, today. Pick up a sample for demonstration purposes. Be ready to cash in on the demand being created now by Miller through national advertising and strong promotion to users in your area. And, for complete catalog information on Sabre, write Dept. 958-C.

miller
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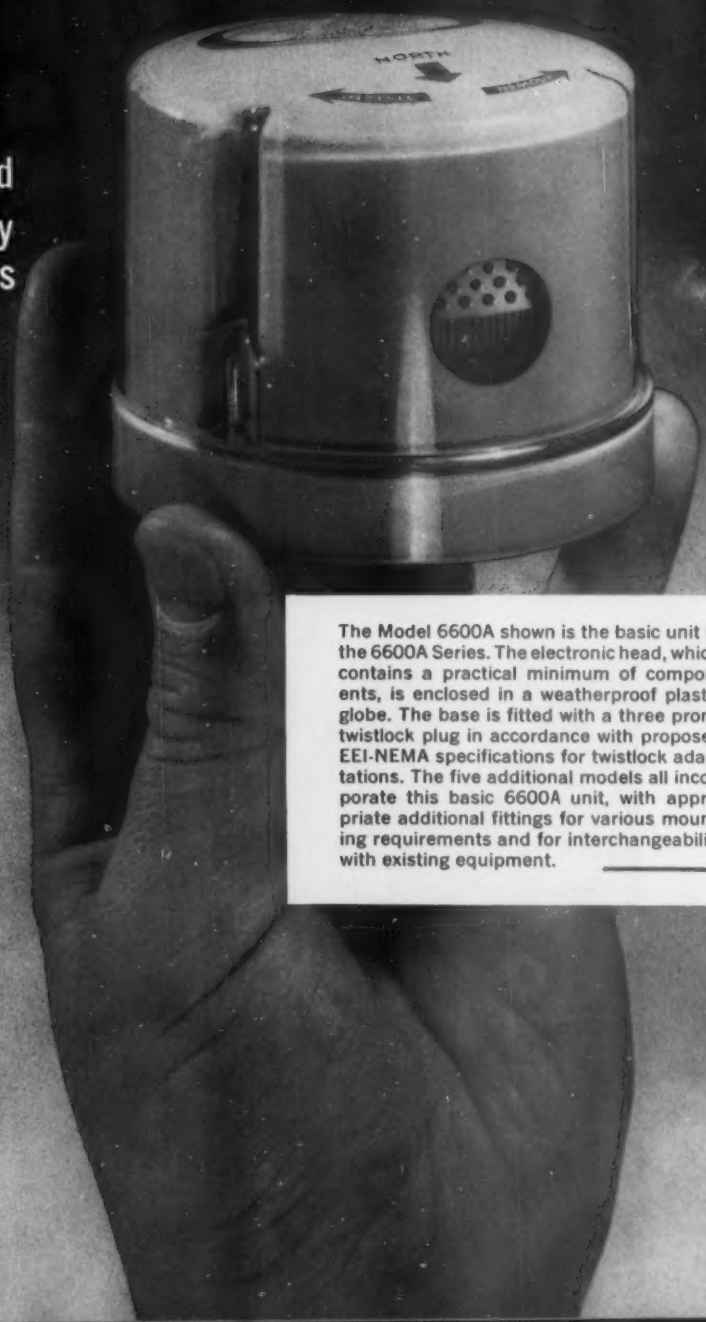
NEW

tubeless

photoelectric lighting control

PROVEN by 27 million unit-hours in the field

GUARANTEED unconditionally for two years

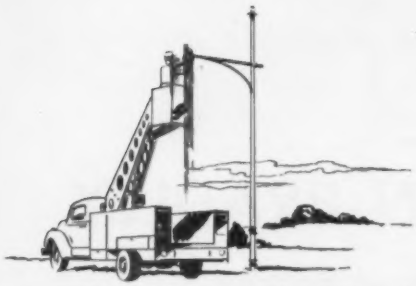


FISHER-PIERCE
series
6600A
ACTUAL SIZE

The Model 6600A shown is the basic unit in the 6600A Series. The electronic head, which contains a practical minimum of components, is enclosed in a weatherproof plastic globe. The base is fitted with a three prong twistlock plug in accordance with proposed EEI-NEMA specifications for twistlock adaptations. The five additional models all incorporate this basic 6600A unit, with appropriate additional fittings for various mounting requirements and for interchangeability with existing equipment.

GUARANTEE

Two-year unconditional guarantee from date of installation, except where mishandling, negligence or direct lightning stroke is cause of failure.



By mid-1958, 60 utilities throughout the country had more than 7000 Series 6600A controls in actual field service. Four years had been spent developing the basic control, testing cadmium sulfide cells and other components, and incorporating the results of operating experience into the design. The single reason Fisher-Pierce did this — *before* offering the control for general sale — was to assure themselves of the *dependability* of the 6600A. The objective was not "to be first" with a tubeless control; instead, it was to achieve true *reliability* in a low-cost, compact unit. The performance of the 6600A now bears out the soundness of this conservative approach.

The 6600A embodies a highly simplified, efficient circuit in a rugged, compact package. No tubes or transistors are used; a CdS photoconductive cell operates a special Sigma relay directly. Major operating specifications and characteristics are briefly listed here, together with a summary of the six 6600A Series models available for various mounting requirements. For more complete information, write The Fisher-Pierce Co., 59 Pearl Street, So. Braintree 85, Mass.

Primary Features

Circuit design of Series 6600A controls reflects conservative derating of all components and thorough attention to protective features. For example, the CdS cell operates on AC and its power dissipation never exceeds 70% of its rating, to insure longer life and greater stability. Also, protection of the cell from direct sunlight and more uniform, dependable turn-on are afforded by control design intended for directional operation.

- Hermetically sealed, broad area cadmium sulfide cell. Every cell is pre-aged and 100% inspected against specifications which resulted from extensive field tests.
- Sigma relay specially designed for use in this control.
- Built-in expulsion-type surge and lightning protection.
- Delayed circuit response prevents false operation due to lightning.
- Weatherproof plastic housing — not susceptible to discoloration, cracking or crazing.
- Metal parts are corrosion-resistant.
- Fail Safe Operation: lighting load will remain turned on in event of failure of electronic circuit.
- Humidity Tested to 100%.

Model 6600A — luminaire or slipfitter mounting (twist-lock receptacle, for bases up to 3" in diam.)

Primary Specifications

Supply Voltage	105-135 volts, 50/60 cycles
Load Rating	1000 watts, incandescent, mercury vapor or fluorescent
Inrush Current Rating	100 amperes
Standard Factory Setting	Turn-on 1.5 ± .5 foot-candles Turn-off 1-2 foot-candles higher than turn-on (Other settings available on order)
Power Consumption	less than 0.5 watt average (0.9 watt max. daytime, 0.06 watt max. night time)
Temperature Range	−55°C to +70°C (−65°F to +158°F)
Weight (basic 6600A control)	8 ounces

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

A-B QUALITY

BULLETIN 798
Multi-Unit Control Centers

Built to ALLEN-BRADLEY QUALITY STANDARDS!

A-B Control Centers are popular because of their Quality Appearance . . . Quality Construction

With control centers more than with individual starters, the appearance is often very important —frequently the control center is used as a "show" installation. The "Quality" built into Allen-Bradley Control Centers cannot be beat —it is a "plus" value which you obtain without extra cost.

Naturally, the installation of an Allen-Bradley Control Center provides additional values—such as those outlined below.

ADAPTABLE TO PLANT CHANGES—Entire units can be moved or complete sections can be added to meet plant changes without the need for changing the internal wiring of the control center.

GREATER SAFETY—Centralized control and locked operating handles prevent tampering by unauthorized personnel. Panels have "dead front" construction with buses and wiring completely enclosed.

MODERN APPEARANCE—This neat, compact installation eliminates the unsightly supporting structures of individually mounted starters and the numerous conduits between separate starters.

LOWER OVER-ALL COST—A-B Control Centers arrive wired and tested. Installation cost is a fraction of that for individual starters. Standardized units eliminate custom engineering.

With Allen-Bradley plug-in type units, starters can be added or removed from the section without disconnecting the rest of the control center from the line.

ALLEN-BRADLEY | QUALITY MOTOR CONTROL

Allen-Bradley Co., 1305 S. First St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

CONSULT YOUR LOCAL ALLEN-BRADLEY REPRESENTATIVE

ATLANTA—Roy E. Wilson Co., 1000 Peachtree St., N.E., P.O. Box 7086, Sta. C., Tel: TRinity 6-8833
BALTIMORE—H. M. Wood & Co., Inc., 124 Light St., Tel: MUlberry 5-4643
BIRMINGHAM—J. L. Howarth Co., Inc., 825 S. 22nd St., Tel: FAirfax 3-1171
CHARLESTON—Henry E. Payne, 918 Kanawha Blvd., E., Tel: Dickens 3-1393
CHARLOTTE—LeRoy P. Spoon, 307 Lincoln St., Tel: EDison 4-6334
CORPUS CHRISTI—Wilson Electrical Equipment Co., P.O. Box 9004, Tel: TUlip 3-2831
DALLAS—J. K. Webb, 2810 McKinney Ave., Tel: TAylor 3-6179
HOUSTON—Wilson Electrical Equipment Co., 3210 Garrow Ave., Tel: CApitol 8-1557
JACKSONVILLE—Robert P. Smith & Co., 1446 June St., Tel: EXbrook 8-0531
KANSAS CITY—B. L. McCreary & Son, 1819 Central St., Tel: HArrison 1-1668
KNOXVILLE—Bowditch & Co., 1311-C N. Broadway, P. O. Box 3145, Tel: 4-2513
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MIAMI—Charles R. Lee & Assoc., Inc., 3524 W. Flagler St., Tel: Highland 4-7414
NEW ORLEANS—Robbins & Robbins, 1037 Magazine St., Tel: JAckson 2-5805
RICHMOND—H. M. Wood & Co., Inc., 2016 Second Ave., Tel: MIlton 3-8529
ST. LOUIS—Allen-Bradley Co., 904 N. Grand Blvd., Tel: JEfferson 5-1901
SAN ANTONIO—Wilson Electrical Equipment Co., 101 E. Maple St., CApitol 4-2344
TAMPA—Robert P. Smith & Co., 3611 So. Coolidge Ave., Tel: 61-5211
TULSA—John W. Elder Co., 1526 East Fourth St., Tel: Diamond 3-9149

So says electrical contractor, Mr. John Lockshaw of Downey Electric Co., Downey, California about a recent installation of the Sunbeam SIGHTLINE® system. He further states, "We believe that the following are the reasons why this lighting job went up so fast and neatly: The fixtures are completely assembled, prewired and ready for connecting circuit leads. The hangers just thread into the swivel sockets. It takes but a twist of the wrist to clamp the system to the mounting plates on the ceiling. The spring-loaded bottom swivels and perfectly balanced fixtures eliminate on-the-job leveling problems. Continuous rows are quickly achieved by interlocking units on sturdy support channels. Fine vertical adjustments can be made *after* fixtures are hung by turning finger-controlled "hex" nuts.
It also amazed us to see these Sunbeam SIGHTLINE® units go up with so little need for tools."

Because SIGHTLINE® is a truly integrated, totally indirect lighting system which produces wide spread illumination with absolutely no glare, direct or reflected, it is being specified more and more for interiors where the utmost visual comfort is required.

SUNBEAM visionaire LIGHTING COMPANY

Sunbeam Lighting Company, 777 East 14th Pl., Los Angeles 21, California & Gary, Indiana

B-M THE ORIGINAL INDENTER FITTINGS

Over 25 Years of Proven Performance

Permanent locked-in bushing insures smooth burr-free raceway for easy fishing. No extra work.

BRIEGEL RED THROAT

1. Protruding rounded red plastic lip of bushing prevents cutting of insulation—eliminates shorts.
2. Full thread screws into all conduit fittings. Lip of RED THROAT bushing protects thread from damage.
3. Deep dished eight pronged lock nut is easier to drive on—screws flush to shoulder and digs into metal of box for vibration proof positive ground.
4. Two quick squeezes with The Briegel Indenter and BM All Steel Indenter Fittings are set forever. Metal is pressed into metal for permanent installation and positive ground.

NEW POCKET SIZE INDENTERS

Just 10" long, these new patented compound leverage indenters are only plier size. Lighter to carry and easier to use—the leverage does the work. No. 607 for ½" and No. 608 for ¾" fittings.

BRIEGEL METHOD TOOL COMPANY

GALVA, ILLINOIS

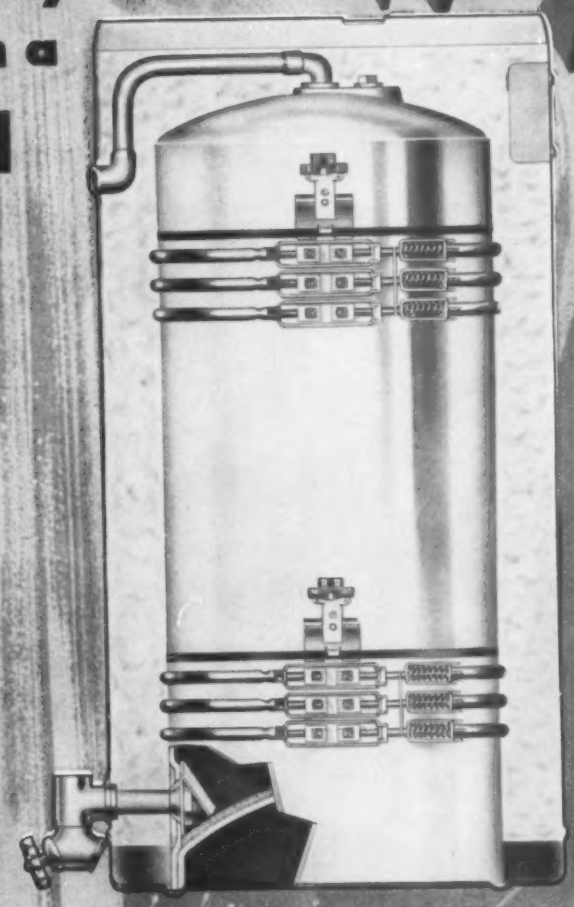
All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

NOW—ALL THE HOT WATER

that any normal family will ever want—from a

40-GALLON TANK!



New Hotpoint SUPER-SPEED Water Heaters are *RIGHT* for 95% of your customers.

Here's tremendous hot water production in a bare minimum of space. Calrod® Magic Circle heat delivers 470 gallons of hot water every 24 hours... and it will raise 18 gallons 100° in just one hour. Even from a cold start, it will heat water for 3 shower baths in 25 minutes.

Hotpoint Quick-Recovery Water Heaters save space and simplify installation. And the new miracle MLC-7 additive in Perma-Seal models can increase the life of the tank by 200%!

SUPER-SPEED Water Heaters will help you put more POWER in "House-Power"—more LIVING in "Live Better . . . Electrically!"

WRITE TODAY FOR COMPLETE DETAILS ON ALL 4 HOTPOINT SUPER-SPEED MODELS

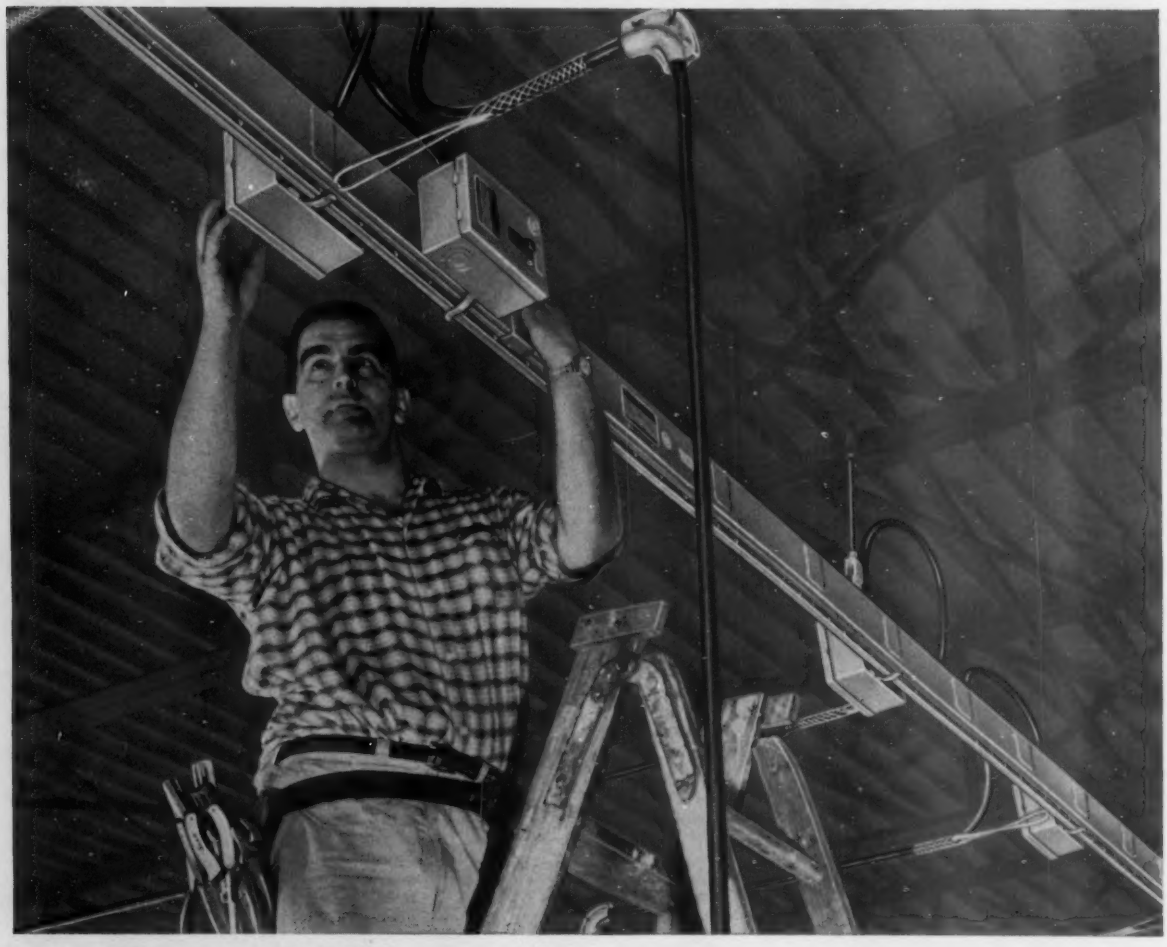
Hotpoint

LOOK FOR THAT DIFFERENCE! (your customers do!)

HOTPOINT CO. (A Division of General Electric Company), CHICAGO 44, ILLINOIS

ELECTRIC RANGES • REFRIGERATORS • AUTOMATIC WASHERS • CLOTHES DRYERS • COMBINATION WASHER-DRYER • CUSTOMLINE • DISHWASHERS • DISPOSALLS® • WATER HEATERS • FOOD FREEZERS • AIR CONDITIONERS • TELEVISION

New idea offers more for the money...



New G-E 100-amp plug-in busway

saves 25% in wiring cost, hailed as "Wiring Method of Tomorrow"

Now, a plug-in busway that costs no more installed—and usually substantially less—than wire and conduit!

Or as a leading electrical contractor in Wilmington, Delaware, puts it: "With Type DH, I can save 25% over the cost of conduit and wire when there are four or more tap-offs in the system."

Type DH—rated 100 amperes, 3 pole or 4 wire, 3 phase 600 volts maximum—serves as either a feeder or plug-in system and may be used wherever exposed wire and conduit might be applied. Light, sturdy and small in size (in cross-section not much larger than a pack of king-sized cigarettes), DH may be hung edgewise on 10-foot centers. Eighteen dead-front outlets are provided in each 10-foot length. For added flexibility, each outlet accepts a variety of fusible, no-fuse and circuit breaker plugs.

G-E distributors, *nationwide*, stock Type DH, including its wide variety of fittings and accessories. So DH busway matches wire and conduit in *availability* as well as cost. Ask your General Electric distributor or representative for Bulletin GEA-6172. Or write directly to **Distribution Assemblies Department, General Electric Company, Plainville, Connecticut.**

DH BUSWAY EXTRA VALUE
Telescoping length adjusts between 42 and 54 inches. This, plus flexible fittings, eliminates need for exact measurements. Rigid fittings—elbows, crosses and tees—adapt busway to virtually any building contour.

OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC

GENERAL ELECTRIC

Holophane

Those who know Lighting Quality

Specify HOLOPHANE

Six decades of constant research and development have earned for Holophane engineers recognition as the foremost illumination authorities... Based on their long experience with prismatic control Holophane has provided the most efficient, economical lighting systems in every field—industrial, commercial and institutional... As an identification of quality, the name Holophane is impressed on each piece.

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Lighting Authorities Since 1898
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A: **PARADOME*** ceiling & suspension types

B: **Nos. 6024-6025:** 2 ft. square PRISMALUME* (acrylic plastic) CONTROLENS* for troffers or panels

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E: **Recessed Incandescent Luminaire;** concave CONTROLENS* for high level Lo-Brite* lighting...

F: **Nos. 641-643 HIBAY*** reflectors; protective drip shield; 400 W. and 1000 W. mercury vapor lamps...

G: **REALITE*:** PRISMALUME* CONTROLENS*

H: **No. 415 Bracket-type** outdoor luminaire

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J: **No. C-824:** Incandescent surface attached corridor light...

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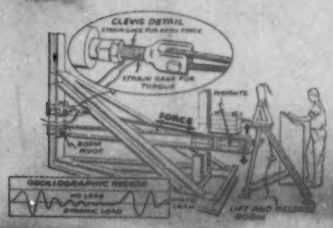
moment of tension

REPEATED 600 TIMES AN HOUR

to prove the relentless holding power of

PREFORMED DEAD-ENDS.*



No. 2 of a series...

One of the most exacting responsibilities in development engineering is that of devising equipment which will closely simulate service conditions in a controlled laboratory environment. In the field of conductor and cable fittings, this poses a particularly complex and important problem. Ordinary down-guys, boom-pendant cables, bridge cables, and other similar installations encounter a rather complex combination of tension, torsion, impact, and vibration. These forces acting simultaneously represent a severe and unpredictable stress configuration which does not lend itself to experimentation using conventional test equipment. The cyclic impact machines at the Preformed Research and Engineering Laboratory were created by PLP engineers to gain a better understanding of the effects of these combined forces on cable fittings of all types.

The equipment incorporates a pivoted beam which is raised and dropped automatically by a system of pneumatic pistons and linkages to obtain desired static and dynamic loads in the attached test specimen. Resultant forces are continuously monitored during the load cycle with multi-gage strain cell instrumentation. Once programed, the machine is regulated to cycle continuously and automatically shut down when major physical changes occur in the test specimen.

This unique equipment makes possible one of many rugged test phases in a continuous program which correlates accelerated laboratory testing with field service experience to provide cable fittings of proven superiority.

Jon R. Ruhlman

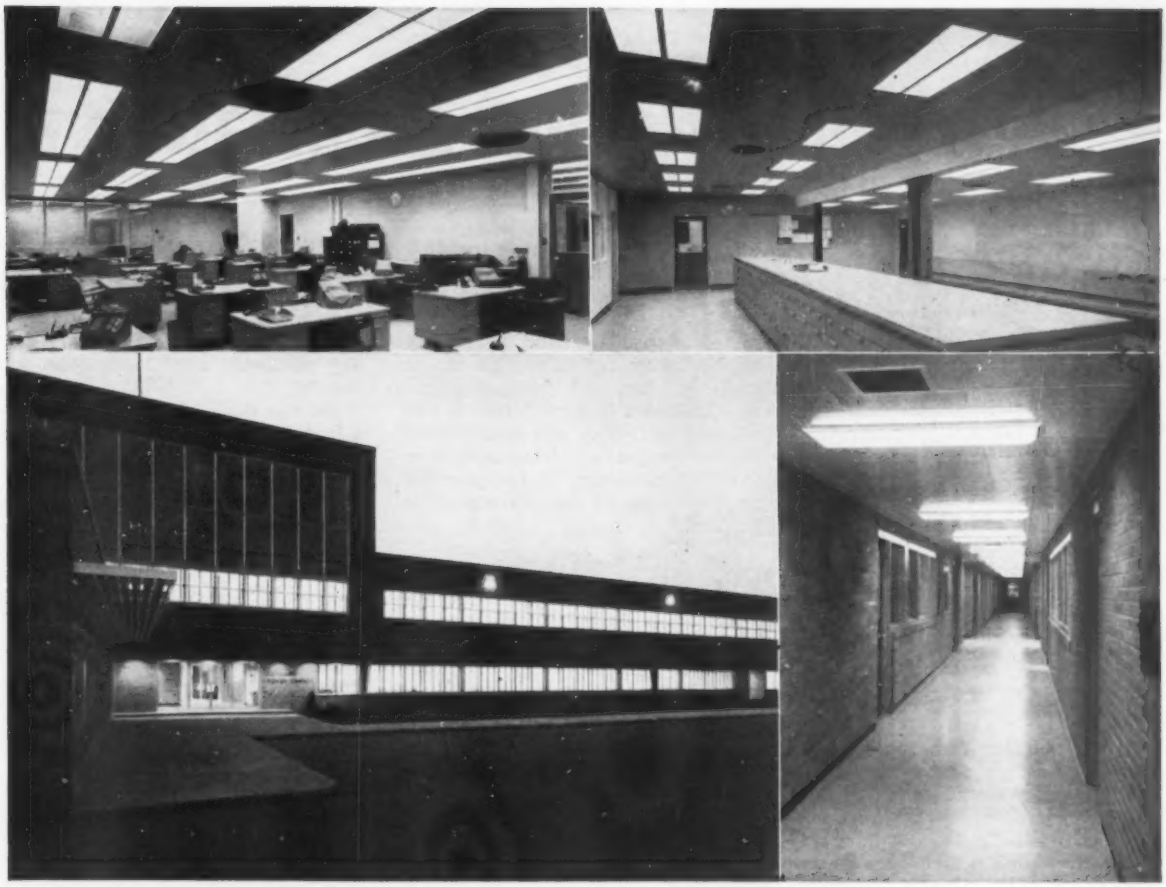
Jon R. Ruhlman, Vice President
Research and Engineering

Research and Engineering . . . another reason why . . .

You can look up to **Preformed** T.M.

PREFORMED LINE PRODUCTS COMPANY • 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable: Preformed-Cleveland . . manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

* Made in accordance with or for use under Patent No. 2,761,273, other patents issued and pending.



26 different types of Day-Brite fixtures provide lighting adapted to ceiling and area functions for CONSUMERS POWER CO., Lansing, Mich. BLACK & BLACK, *Architects;* E. ROGER HEWITT ASSOCIATES, *Consulting Engineer;* LANSING ELECTRIC MOTOR, *Electrical Contractor.*

The tough lighting jobs go to DAY-BRITE

At Consumers Power Co., the lighting fixtures had to conform to each area, every situation. Fixture installation could have been a problem.

But not with *Day-Brite* fixtures, designed for smooth integration with standard ceiling assemblies by the developers of the Ceiling Indexing System.

Nearly all lighting problems can be solved more easily with stock Day-Brite fixtures and hangers. Let your Day-Brite representative prove it. You'll find his name in the Yellow Pages of your telephone directory.

Z-441 ©Day-Brite Lighting, Inc. 1958

DECIDEDLY BETTER
DAY-BRITE
LIGHTING FIXTURES

Day-Brite Lighting, Inc., 6264 N. Broadway, St. Louis 15, Mo.
Day-Brite Lighting, Inc., of Calif., 530 Martin Ave., Santa Clara, Calif.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

New concepts for illumination

By R. T. Dorsey
Supervisor Commercial Lighting
and E. A. Linsday
Supervisor Industrial Lighting
Large Lamp Department
General Electric Company
Cleveland, Ohio

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

Editor's Note: For more than eight years studies have been proceeding under the direction of Dr. H. Richard Blackwell, at the University of Michigan, to develop practical answers to the question how much light is needed to perform efficiently various visual tasks. The studies have been made under a grant of the Illuminating Engineering Research Institute, and the results are now being used by the IES Committee on Standards of Quality and Quantity as a basis for raising IES recommended lighting levels. There is evidence now that some of the increases in recommended lighting levels will be substantial, and the lighting industry will need all of the background material it can assemble to sell these higher levels. The accompanying article relates current recommended practices to ultimate lighting objectives.

◆ THE SUBJECT of levels of illumination has two aspects:

(a) **Recommended practice** — based on weighing all the factors in terms of today's knowledge of seeing and today's cost of lighting.

(b) **Establishing objectives** — what is best seeing? Also, what are the environmental factors that make an area a place where people like to work, shop, play, etc.?

Both of these aspects are important. However, current recommendations in effect say, "Here is our evaluation of what is justified for your installation." Whereas the concept of optimum lighting puts the lighting industry in quite a different position and gives the user a much clearer picture of the real need for, and value of, lighting. In effect it says, "Here is the kind of light that will enable your workers to perform best; now, how far is it necessary to compromise on the basis of today's economic factors?"

IES light levels

The IES R.Q.Q. Committee arrived at a system of categorizing tasks as to "most difficult, very difficult, difficult, easy, and casual." Footcandle ranges were then assigned to these categories based on a preliminary estimate of the over-all picture. Then the individual committees arrived at specific recommendations based on the particular factors in their own fields. This resulted in approximately double the previous levels.

Another important concept was introduced—these levels are "on the task at any time." "On the task" means that variation in illumination throughout the room is recognized; both from the standpoint that levels tend to be lower near the walls, and that in many areas it is practical to concentrate light in the vicinity of the task and allow lower levels in circulation areas, etc. "At any time" means fall-off of light in time is given greater recognition.

Progress toward the goal of establishing optimum visual environments divides into five interrelated subjects:

(a) Best seeing
(b) Stimulating environment
(c) Comfortable contrasts
(d) Interesting contrasts
(e) Dynamic lighting

Best seeing: We have known since the early work of Luckiesh, Guth, and others that there is a tremendous range in illumination of various tasks to provide equal visibility. The question is, what is the illumination for each task for the *best* visibility?

For difficult tasks involving low contrasts, low reflectance, and small size, it is generally agreed that illumination levels of several hundreds and even thousands of footcandles are needed. The question then comes down to considering relatively easy tasks such as reading.

On the basis of visibility alone, a high level of accuracy and speed is obtained at one or two footcandles. But there are many factors that indicate that seeing improves up to the 300 to 1000 footlambert range.

In addition to the previously studied factors of blink rate, heart rate, nervous muscular tension and convergence reserve, a new study by Alpern (in Blackwell's group) involved measuring the ability of the eye to focus and converge. This shows increasing benefits above the thousand footlambert range.

The 300 to 1000 footlambert range covers the values that would be chosen by most people as the maximum adaptation brightness they would enjoy.

Thus the conclusion is that best seeing must lie within this range since below it, seeing is less than optimum and above it people are visually uncomfortable. Footcandles are specified, of course, on the basis of reflectance of the task. This concept also recommends that for some very difficult tasks one might choose to provide levels above this range for short periods of time.

Stimulating environment: It is well established that as the general levels of brightness in an area are increased, activity in the area is stimulated. Evaluation here is more subjective than quantitative. We do know that the environment on a bright sunshiny day is pleasant and stimulating and that as it becomes cloudy, as we get into the shade, or as the day wanes, the environment is less stimulating.

Based on reflectance of trees and grass this will indicate that the brightness of things in an area of regard ought to be roughly 1000 footlamberts and that some areas could well be higher (blue skies are about 1000 footlamberts

levels

and white clouds might be as high as 6000).

With the typical reflectances of office tasks, for example, as well as light interior finishes, this would indicate that the more stimulating and yet comfortable environment indoors is in the 300 to 1000 footcandle range.

Comfortable contrasts: Much has been learned in this area and we know enough to keep contrasts in the spaces surrounding the tasks down to 3 to 1 or less and to avoid harsh contrasts throughout the room.

Interesting contrasts: (This is closely related to stimulating environment.) We know that at a thousand footcandles outdoors on the overcast day, part of the effect on us is lack of contrast in *illumination*. Bear in mind that there is just as much contrast in reflectance and in color on an overcast day as there is on a bright sunshiny one. This is why we say contrast in illumination rather than contrast in brightness.

This concept may have a greater bearing on acceptance of higher levels than we have thought in the past. We have already experienced the fact that 400 footcandles in an office can be uninteresting and that the addition of a spotlight on a feature makes a difference in two principal ways.

First, it introduces directional light which is the counterpart of sunshine. Secondly, it establishes an area that is higher in brightness than most of our environment. We therefore feel that the effect of the general level of illumination is softer and more pleasing.

This concept has been applied in store lighting for a long time. It seems clear that it will be applied to factories, offices, and schools as well.

Dynamic lighting: We know that natural lighting conditions are not static and that the changes that occur have a lot to do with our enjoyment and our motivation. Applying this idea indoors is going to require some new design data. On the other hand, we have

(Continued on page 132)

HOW MUCH LIGHT?—This Nela Park office, where the lighting is controlled by a dimming switch, now has 50 footcandles. This level has long been considered fully adequate for office work. Many offices, of course, do not have even this level which is substantially lower than the latest IES recommendations for desirable seeing conditions for sustained visual tasks.

TWICE THE LIGHT—At 100 footcandles, the same office has achieved a marked lift in aiding the occupants to see quickly, accurately and comfortably by comparison with the lower level.

DOUBLE AGAIN—At 200 footcandles, these engineers and their secretary enjoy a remarkably effective visual comfort well above the "advanced" installations now winning acceptance.

ULTIMATE?—A turn of the controls brings the level up to 450 footcandles, which is so well shielded the comfort approximates that we find in the shade of a tree. Another feature essential to the outdoor summer comfort of this office is the choice of reflectance values in the appointments. Light colors, which predominate, contribute to the cheerfulness of the environment.

New recommended lighting levels

This article should be especially helpful to the following readers:

Electrical Contractors ✓
Electric Utilities ✓
Electrical Wholesalers ✓
Electrical Inspectors ✓
Industrial Engineers ✓
Consulting Engineers ✓

◆ TEN APPLICATION committees and sub-committees of the Illuminating Engineering Society haave increased their recommended lighting levels for hundreds of specific seeing tasks within their specialized fields by an average of 150 per cent, reports C. L. Crouch, technical director of the organization.

The average increase includes recommended levels that remain unchanged from the individual task levels published by the I.E.S. in 1952, and some that have been decreased as well as those increased, Mr. Crouch pointed out.

The new tables of recommended practices will be published in full early next year in a new edition of the society's Lighting Handbook, a guide to sound illumination practice widely used by architects, consulting engineers, lighting designers and related professionals.

The committees of lighting authorities arrived at the new levels after five months of study and revaluation of long lists of seeing tasks following the announcement of new scientific knowledge concerning the lighting needs of the human eye. This new knowledge was developed by Dr. H. Richard Blackwell and a team of vision experts at the Vision Research Laboratories of the University of Michigan during a critical eight-year study of the relationship of light to sight. Dr. Blackwell, during the period of the study, was associate professor of psychology and physiological optics at the university as well as director of the vision laboratories.

"The Blackwell Studies are of major importance because they give us a valid, scientific basis of footcandle recommendation and thus fill a gap in our knowledge that has long baffled our committees," said Kirk M. Reid, president of the society. "For the first time we now can scientifically determine the necessary lighting levels for individual tasks rather than merely for the broad areas in which the tasks are performed," he explained.

Scientifically accurate

The new system is considered by leaders in the illumination field to be the most scientifically accurate and adaptable technique for evaluating lighting needs.

Four of the Illuminating Engineering Society's 14 specialized technical committees have not yet completed studies and field tests in which they also are applying Dr. Blackwell's visual data to specific seeing tasks. Their recommendations are expected to be submitted to the society's governing body shortly. Those committees which have completed their studies, however, have tabulated their recommendations which were approved in each case by a ballot of the members of each committee involved.

Many of the new recommendations issued thus far are presented below. They deal with specific lighting recommendations in certain fields of specialized lighting.

Dr. Blackwell and his associates began their light and sight studies in 1943 at the Vision Research Laboratories of the University of Michigan, under a U. S. Navy contract. Subsequently their work was expanded in scope with the support of the Illuminating Engineering Research Institute.

Basic work was carried out under ideal testing conditions. Key to the studies was a testing cubicle in which subjects performed seeing tasks of various degrees of difficulty represented by projected disks of light of varying sizes, intensities, and periods of time.

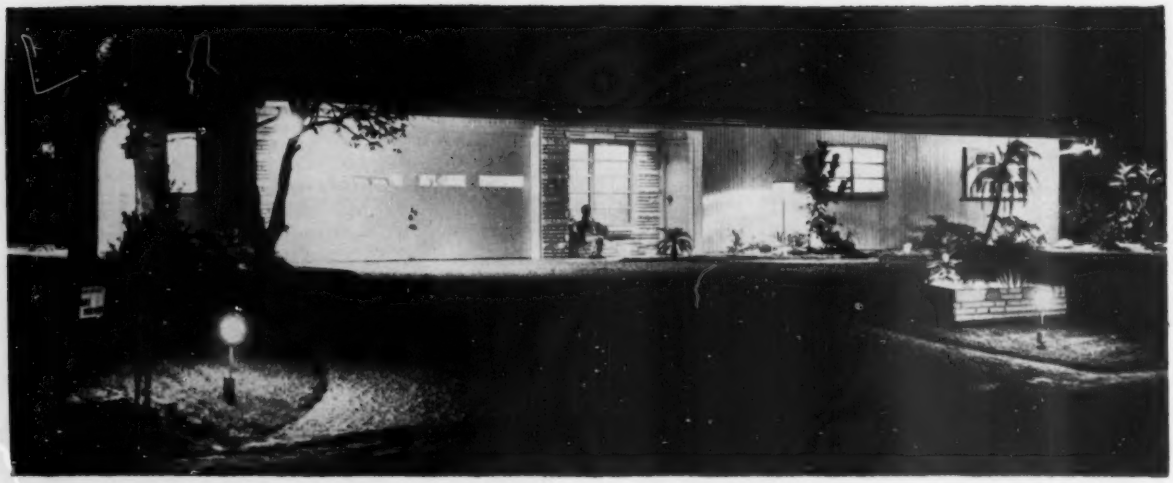
These laboratory tests developed a mass of statistical data in terms of "difficulty of seeing." In order to relate the data based on laboratory targets to actual seeing tasks in the field, Dr. Blackwell devised a complex optical instrument which he called a Visual Task Evaluator. He also developed a set of mathematical "factors" to adjust the data for such practical field conditions as motion and degree of required accuracy of seeing. The new IES recommendations were thus evolved.

Footcandles recommended	New	Old
Airplane manufacturing:		
Stock parts—		
Production	100	50
Inspection	200	100
Parts manufacturing—		
Drilling, riveting and screw fastening	70	30
Spray Booths	100	30
Sheet aluminum layout and template work; shaping and smoothing of small parts for fuselage; wing sections, cowling, etc.	100	50
Welding—		
General illumination	50	30
Supplementary illumination	1,000	1,000
Sub-assembly—		
Landing gear, fuselage, wing sections, cowling and other large units	100	30
Final assembly—		
Placing of motors, propellers, wing sections and landing gear	100	30
Inspection of assembled ship and its equipment	100	50
Machine tool repairs	100	100

Footcandles recommended	New	Old
Airplane hangars:		
Repair service only	100	—
Assembly:		
Rough easy seeing	30	20
Rough difficult seeing	50	—
Medium	100	50
Fine	500	100
Extra fine	1,000	300
Automobile manufacturing:		
Frame assembly	50	30
Chassis assembly line	100	—
Final assembly and inspection line	300	—
Body manufacturing—		
Parts	70	30
Assembly	100	30
Finishing and inspecting	300	200
Chemical works:		
Hand furnaces, boiling tanks, stationary driers, stationary and gravity crystallizers	30	5

Footcandles recommended	New	Old
Chemical works (con't):		
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizers, bleaching	30	10
Tanks for cooking, extractors, percolators, nitrators, electrolytic cells	30	20
Cloth products:		
Cloth inspection	2,000	30 to 300
Cutting	300	30 to 300
Sewing	500	30
Pressing	300	30 to 100
Dairy products:		
Fluid milk industry—		
Boiler room	30	10
Bottle storage	30	10
Bottle sorting	50	50
Bottle washers	300	300
Can washers	30	20
Cooling equipment	30	20
Filling: inspection	70	50
Gages	50 (on face)	30
Laboratories	100	50
Meter panels	50 (on face)	30
Pasteurizers	30	20
Separators	30	20
Storage refrigerator	30	10
Tanks, vats		
Light interiors	20	10
Dark interiors	100	100
Thermometer	50 (on face)	30
Weighing room	30	10
Scales	70	30
Electrical equipment manufacturing:		
Impregnating	50	30
Insulating: coil winding	100	100
Testing	100	50
Exterior areas:		
Entrances—		
Active (pedestrian and/or conveyance)	5.0	2
Inactive (normally locked, infrequently used)	1.0	0.5
Vital locations or structures	5.0	2.0
Building surrounds	1.0	0.5
Active shipping area surrounds	5.0	2.0
Storage areas—active	20	—
Storage areas—inactive	1	—
Loading and unloading platforms	20	—
Foundries:		
Annealing (furnaces)	30	10
Cleaning	30	20
Core making (fine)	100	50
Core making (medium)	50	25
Grinding and chipping	100	30
Inspection (fine)	300	100
Inspection (medium)	100	30
Moulding (medium)	100	50
Moulding (large)	50	30
Pouring	50	10
Sorting	50	10
Cupola	20	10
Shakeout	30	10
Inspection:		
Rough	50	20
Medium	100	50
Fine	500	100
Extra fine	1,000	200
Machine shops:		
Rough bench and machine work	50	20
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing	100	50
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing	500	100
Extra fine bench and machine work, grinding—fine work	1,000	200
Materials handling:		
Wrapping, packing, labeling	50	
Picking stock, classifying	30	
Loading, trucking	20	
Inside truck bodies and freight cars	10	10
Packing and boxing	30	10
Paint shops:		
Dipping, simple spraying, firing	50	20
Rubbing, ordinary hand painting and finishing art, stencil and special spraying	50	20
Fine hand painting and finishing	100	50
Extra fine hand painting and finishing (automobile bodies, piano cases, etc.)	300	100
Plating	30	10
Polishing and burnishing	100	20
Sheet metal works:		
Miscellaneous machines, ordinary bench work	50	20
Presses, shears, stamps, spinning, medium bench work	50	20
Punches	50	25
Tin plate inspection, galvanized	200	50
Scribing	200	100
Stairways, washrooms and other service areas	20	10
Storage rooms:		
Inactive	5	1
Active		
Rough bulky	10	5
Medium	20	10
Fine	50	20
Testing:		
General	50	20-30
Extra fine instruments, scales, etc.	200	100
Welding:		
General illumination	50	30
Precision manual arc welding	1,000	—

Footcandles recommended	New	Old
Woodworking:		
Rough, sawing and bench work	30	30
Sizing, planing, rough sanding, medium, machine and bench work, glueing, veneering, cooperage	50	50
Fine bench and machine work, fine sanding and finishing	100	100
Art galleries:		
General	30	10
On paintings (supplementary illum.)	30	50
On statuary and other displays	100 minimum	
Hotels:		
Auditoriums		
Assembly only	15	10
Exhibitions	30	30
Dancing	5	5
Bathrooms		
Mirror	30	40
General	10	10
Bedrooms		
Reading (casual periods)	30	30
Writing (casual periods)	30	30
Mirrors (dresser and dressing table)	20	20
General	10	10
Corridors and stairs	15	10
Dining areas (see Restaurants)		
Elevators	15	
Entrance foyer	30	
Front office	50	
Kitchen (see Restaurants)		
Laundry		
Washing	30	40
Flat work ironing	30	40
Machine press finishing	50	40
Linen room—sewing	70	20-150
General	15	20
Lobby		
Commercial hotel	20	20
Residential hotel		
Architectural environment	10	
Reading and working area	30	
Marquee		
Dark surroundings	30	—
Bright surroundings	50	—
Restaurants:		
Lunch rooms, cafeterias		
Dining areas—intimate type	3-10	10
(Cleaning	20	
(Leisure type	15-30	
(Quick service type	50-100	
Food displays — twice the general level but not under	50	50
Service areas (see commercial kitchens)		
Kitchen, commercial		
Inspection, checking and pricing	70	20
Other areas	30	
Office lighting:		
Cartography, designing, detailed drafting	200	50
Accounting, auditing, tabulating, reading poor reproductions, rough layout drafting	150	50
Regular office work, reading good reproductions, reading or transcribing handwriting in hard pencil or on poor paper, active filing, index references, mail sorting	100	30
Reading or transcribing handwriting in ink or medium pencil on good quality paper, intermittent filing	70	30
Reading high contrast or well-printed material, tasks and areas not involving critical or prolonged seeing such as conferring, interviewing, inactive files and washrooms	30	10
Corridors, elevators, escalators, stairways	20	5
Store lighting:		
Price tag A—printed	3	—
Price tag B—written in pencil	250	—
Sales slips—pencil writing	65	—
Subtle color patterns	900	—
Clothing—light colored pattern	800	—
dark colored pattern	900	—
Linens—white thread on white cloth	3,000	—
Package labels—good contrast	3	—
poor contrast	65	—
Shirts—sewing at corner of pocket light color	2,000	—
Furniture—wood textures	200	—
Show windows		
Daytime lighting		
General	200	200
Feature	1,000	1,000
Nighttime lighting		
Main business districts—highly competitive		
General	200	200
Feature	1,000	1,000
Secondary business districts or small towns		
General	100	100
Feature	500	500
Store interiors		
Circulation areas	30	20
Merchandising areas—		
Service stores	100	50
Self-service	200	100
Showcases and wall cases		
Service	200	100
Self-service	500	200
Feature displays		
Service	500	200
Self-service	1,000	500
Stockrooms	30	20



Specially designed fixtures highlight the exterior and grounds of this home in which Sarasota Electric installed a 42-circuit panel. More homebuyers are looking for homes with outdoor lighting facilities.

Creative lighting opens the door

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✓

◆ "THE ELECTRICAL contractor who arms himself with a light meter, and makes up his mind to learn enough about creative lighting to offer his customers a complete wiring package that takes cognizance of their particular need, can lift his wiring business up from the silt of mediocrity and enter a field which is a challenge and a continuing profit opportunity and will help project him from a trade into a profession," says Si Bell, president of Sarasota Electric Corp.

"Lighting is a field horribly neglected by the electrical contractor, yet it is his most prolific profit potential. Lighting installations—good or bad—comprise 90 per cent of our business, yet some contractors show a profound disinterest in installing a lighting system according to recommended illuminating engineering practice.

"Aside from assuring the customer of such practical and obvious factors as conventional lighting circuits and conventional fixtures, there is an untapped field in esthetic lighting. The use of color in outdoor residential lighting and the creation and design of unconventional fixtures and lighting arrangements to produce a decor or desired effect in a cocktail lounge, restaurant, or recreation hall to carry out some cherished theme of the owner's, add up to an aspect of the electrical business in which the contractor will find little if any competition.

"It is on this basis alone that we are handling a most satisfactory volume of this type of business," says this veteran contractor.

Besides winning state awards for novelty and practicality, Bell's wiring designs and their unusual nature are played up in the area newspapers. This results in the sort of publicity that attracts customers for his creations.

Quality of illumination

According to Bell, merely providing the proper quantity of illumination does not necessarily guarantee a satisfactory lighting installation. He counts of equal importance the "quality" of illumination. He says: "A well-engineered system will provide proper light in the right places with maximum over-all economy, no objectionable glare, and no harsh shadows."

"While it is the architect who usually dictates the nature of the wiring system," Bell points out, "his planning is seldom aided by consultation with an illuminating engineer or the electrical contractor who will do the work.

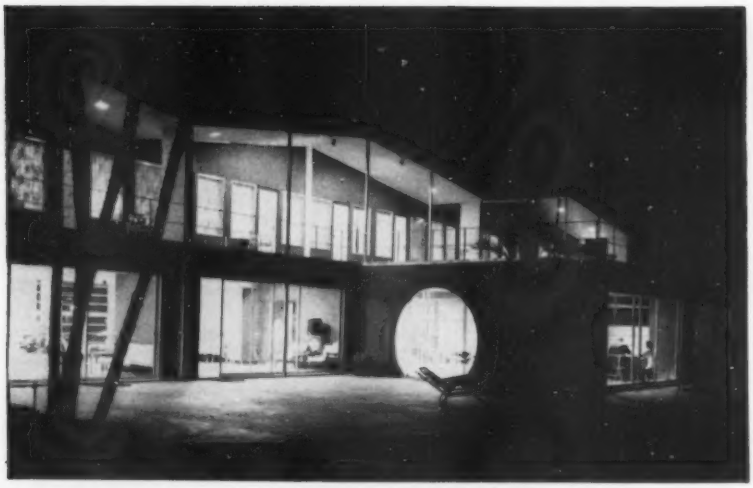
"The architect may rely upon obsolete brochures in making his selection of fixtures, or he may get his ideas from a fixture salesman who is interested in selling fixtures which may be the most expensive, and at the same time, the least suitable for the proposed installation.

Alternate plan submitted

"While it is true that the architect recommends and the wholesaler sells the fixtures, it is the electrical contractor who is truly the closest to the job. He makes the installation. He sees its effect. He sees its lack of effect.

"If the contractor generates any enthusiasm about the proposed lighting system, he can approach the architect and give voice to his ideas in a manner that will assure consideration."

In Bell's case, while he bids on the basic plan, he also studies the job and makes an alternate plan based on his experience and on what he deems best for the customer's job. Then he submits both bids for consideration. He finds it



Even the speculative builders are realizing that the use of color lighting —inside and outside—creates buying appeal for homes.

to added profits

more effective to contact the owner, especially if that person contemplates a business enterprise.

Bell explains the benefits of the alternate plan and the changes that will enhance the owner's business and save future expense and the costly revampings of a skimpy wiring system. He has discovered that the more hardheaded a businessman the customer is the easier he is to convince about spending more money and getting the sort of lighting arrangement which will help the sale of his merchandise.

"We find our sales pitch more effective when we're dealing directly with the owner," says Bell, "and we can only do this by making an honest and earnest study of his situation before making recommendations. We try to gain an understanding of his problems and objectives. That way we often get carte blanche on the job, and we eliminate competition."

Admitting that this takes time and creative thinking and techniques, Bell points out that the contractor who seeks to enter this select field and is tired of deriving a meagre commission on his fixture work, has many mediums from which to draw inspiration and knowledge for his plunge into creative and meaningful lighting designed to do a selling job for his customer.

From trade to profession

"The fact that the contractor manifests a desire to do a better lighting job sets him above his competitor who is content to install a $2-fixture," said Bell. "By doing some extra-curricular homework, and designing an original installation that will truly help his customer, he lifts himself out of a mundane trade and into a profession in which he can be proud of his work.

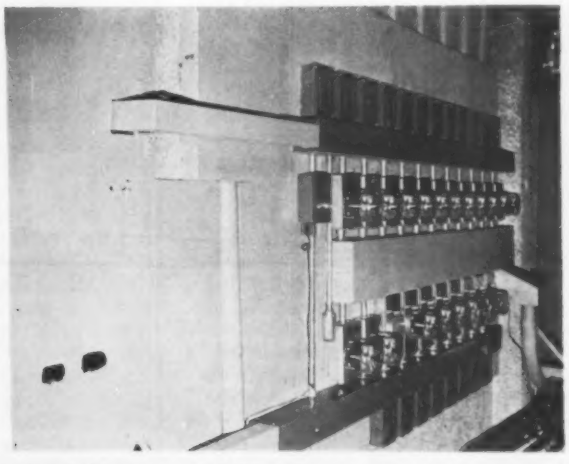
"The contractor who learns to install a lighting system that creates the intimacy so desired in a fancy cocktail lounge, to fashion a lighting arrangement to highlight a seascape in a motel to foster the vacationing spirit, or to evolve daring lighting effects that spur customers to impulse buying of merchandise like women's clothes or gifts, will soon find himself besieged—not with customers, but with 'clients.' "

In Bell's practice of contacting architects lies the strategy of offering his helpfulness so that the architect's job can be improved for the architect's client.

"We scrutinize each plan we're bidding on very carefully," he

(Continued on page 126)

Bell keeps on file pictures such as these to help in convincing prospective customers of the safety,



convenience, and appearance the customer can expect from a modern, well-planned installation.

To restore light reflecting efficiency of reflectors wash them with a sponge and a sudless detergent.

Repaint dirty ceilings and walls to restore their reflecting function and improve lighting efficiency.

Planned maintenance for better lighting

By Robert L. Zahour

Lamp Division
Westinghouse Electric Corp
Bloomfield, N. J.

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers ✔
- Consulting Engineers

◆ ANY INDUSTRIAL lighting system must have periodic maintenance to provide efficient lighting performance. During months of operation, certain conditions develop which tend to decrease the light output of each fixture and consequently lower the footcandle level at the working areas.

These conditions which contribute to the loss of light from the time when the lamps and fixtures are new and clean are:

1. Accumulation of dust and dirt on fixture reflecting surfaces.
2. In rooms where walls and ceilings reflect a large percentage of light to the working areas, dust and dirt accumulations on these surfaces will absorb light.
3. Burnouts and aging of lamps.

Dust and dirt on fixtures

Dust and dirt which is allowed to collect on the lighting equipment absorbs light which is paid for by consumption of electricity, yet never reaches the working areas. In a year's time, accumulations of dust and dirt on the reflecting surfaces of fixtures and on the lamps can reduce the delivered illumination as much as 30 per cent, and even more in extremely dusty or dirty areas.

To avoid this costly depreciation, footcandle meter readings should be made every few months after installing a new lighting system or after a cleaning and relamping period, to detect loss of light. When the average illumination drops to 20 per cent of initial, a fixture cleaning schedule should be established to periodically remove dust and dirt accumulations. This operation can be done most economically when a crew with proper cleaning equipment does the job at one time. Merely wiping the fixtures with a dry cloth is not enough, for this method does not remove the crusted layer, but may scratch reflecting surfaces.

When fixtures can be taken down all surfaces should be washed with a sponge and a sudless detergent and then rinsed with clean water. Wipe off moisture with a clean cloth, and avoid getting water in sockets. If fixtures cannot be removed, a cleaning agent should be used that requires no rinsing. Wipe off excess moisture with a clean cloth. Lamps, too, should be cleaned—but only when cool enough to avoid water cracks.

In areas where the walls and ceilings reflect a good percentage of light, these surfaces should be periodically cleaned or repainted when they have become dusty and

(Continued on page 121)

Economy sells high level illumination

Working with intricate equipment requires good lighting, and this first-in-the-area 277/480 volt system provides maximum see-ability at Sarasota's Electro Mechanical Research plant.

Wheeler fixtures supply adequate lighting at assembly-line tables in the new Electro Mechanical plant which represents the largest building permit ever issued in the county where it is located.

By Harry J. Miller

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electrical Utilities ✔
Electrical Wholesalers ✔
Electrical Inspectors ✔
Industrial Engineers ✔
Consulting Engineers ✔

◆ ECONOMY has proved to be the basic factor in selling the management of one of Florida's newest industrial organizations on plant electrical distribution at 277/480 volts.

Electro - Mechanical Research Company, a former New England concern which moved to Sarasota late in 1956, having outgrown its initial structure, has just completed another building designed to add 30,000 square feet to the original 45,000 square foot area. Representing one of the largest building permits ever issued by the local building permit department, the new building will feature high level illumination served from a 277 volt system.

Wired by Sarasota Electrical Contractor J. S. Cobb, the lighting was engineered by local engineer Kenneth Brumbaugh. He said: "Previous installations for EMR in other locations had been provided with 30 to 40 footcandles of general lighting supplemented by higher level local illumination.

"This installation was designed for 75 footcandles of general lighting with an alternate for 125 footcandles. For approximately a 20 per cent increase in cost, EMR agreed to the higher level of illumination and very little supplementary lighting was required.

277/480-volt system

"With minor exceptions, all lighting is supplied from a 277/480-volt system.

"The lamps are the conventional two-lamp, 8-foot louvered, porcelain enameled industrial fixtures with 28 per cent upward component. Standard cool white, high

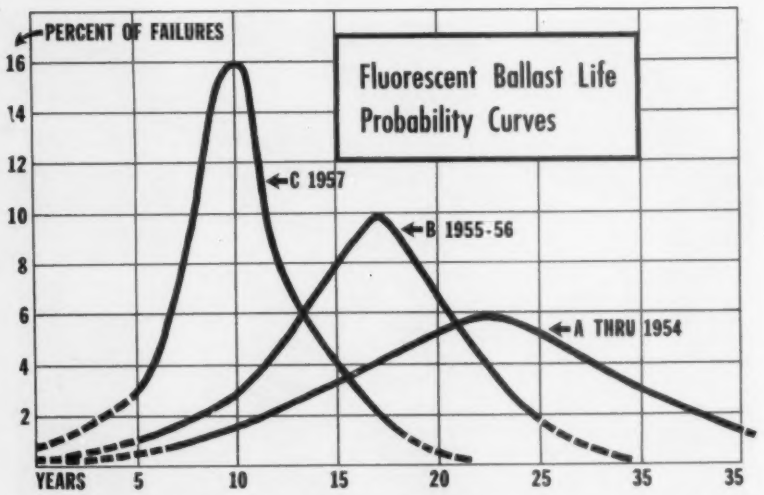
(Continued on page 130)

New look at lighting system progress

By W. C. Anderson
Chief Project Engineer
Jefferson Electric Company
Bellwood, Illinois

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔



Trends in lighting fixture design and application have been such that ballast life has been drastically reduced in the last few years. However, there is evidence that a turning point has been reached and that considerable improvement will result from the studies now being made.

◆ THE POPULAR CONCEPTION of progress is too frequently based on the short range view. A new design that demonstrates superiority in some feature or features over its predecessors is, more correctly, an improvement with regard to a specific problem and may bear no immediate relationship to progress in the true sense of the word. I believe the true meaning of progress must be taken from the long range view.

The dictionary includes among its definitions of progress these statements: "Advance to an objective. Gradual betterment. Movement forward." All of these definitions imply a continuing development over a long period of time.

Practical experience has proved to all of us that this concept of progress must be the correct concept. We have also learned that progress is something you fight for, sometimes bitterly, sometimes heroically, quite often with no apparent success, but never, in the final analysis, in vain.

We know, too, that the best line curve of any history of progress has points above and points below the line. We move in fits and starts, the road is up and down, the way is strewn with obstacles, but we do move forward toward our objectives—gradually, surely. Such is the way of progress.

The problems that confront you at any given moment can be resolved, and are resolved, but sometimes the resolution introduces new problems, unforeseen perhaps, but just as real and perhaps more disturbing. Once in a while, fortunately not often, a solution to a specific problem, hailed with loud hurrahs, spawns another set of problems that flourish long after the shouting dies. This, on the arduous road of progress, represents an obstacle. Temporarily you are set back—but only temporarily. The solutions to the new problems invariably carry you beyond the obstacle, a few steps closer to your objective.

Thus far, I have sounded more like a philosopher than an engineer; I have spoken more hypothetically than categorically. Now I would like to be explicit—to cite a specific condition that exists today. I would like to review the events that brought about this condition and to tell you what is being done to remedy the condition.

Ballast heating problem

About a year ago, the fluorescent lighting industry became painfully aware that ballasts in fixtures were running too hot. Except for a few earlier portents and an occasional voice raised in warning, this was a sudden awakening. In retrospect, it seems as though one day everything was all right and the next day everything was all wrong. Of course, it was not really like that. The wrongs existed for some time. It was the industry-wide recognition of the problem that was sudden.

What had happened? How could this happen to an industry so conscious of specifications, so continually concerned with proper application, so demanding of quality performance?

The answers can be found, I believe, but you have to go back several years. The history of the 2-lamp, 40-watt, rapid-start ballast and its relationship to the earlier preheat ballast will clearly illustrate the heating problem. Let us go back to 1955, a year that seems to me to hold the key to the problem.

Ballast size reduced

In 1955, the first narrow cross-section ballasts were made available to fixture manufacturers. These ballasts were the result of an intensive effort on the part of the ballast designer to meet the demands for ever shallower fixtures.

A major step in that direction had been taken late in 1953, when

(Continued on page 135)

This master control panel utilizing a low-voltage remote control switching system is the center of operation for all the alleys in this modern bowling center. Touch-Plate switches were used throughout.

Commercial uses for remote control

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ LOW-VOLTAGE remote control switching for electric circuits is finding wide application in commercial establishments as well as residences. The advantages of flexibility in number and location of switches, as well as the economy achieved by keeping runs of actual power circuits to minimum length, are as applicable to commercial establishments as they are to homes.

In some instances, the application of remote control switches can effect special economies in commercial establishments. For example, a central control system for all of the lights on 32 bowling alleys in one large recreational center has enabled the center to operate with a minimum of personnel.

The operational cost of maintaining such a sports center has been reduced to a minimum through the use of automatic pin-setters, and the further automation presently being supplied through use of low voltage switches to control alley lights, overhead lights, time delays, and recycling of automatic pin-setters. Foul line lights are also controlled by low voltage switching from the main desk. With the reduction of costs comes better profits for the operators of the center.

From the master control center at the main desk, one man on duty can oversee all alleys, because all lanes are equipped with time-delay and trouble light Touch-Plate circuits controlled from this central position. The time delay panel promotes smoother operation of the bowling alleys by speeding up play during peak periods, thus allowing more people to use the facilities. When a ball has not been thrown for 45 seconds in an alley in use, a blue switch light is illuminated on the master control, indicating one of two things: either the player has left the alley, in which case the management can determine whether or not he has paid his bill, or the player is simply taking too much time. There are fewer arguments about this now that the timing is done electronically.

Another important use of the time delay control panel is for recycling the automatic pin-setting machines. At any time, the man

(Continued on page 131)

High frequency lighting proves means

By R. D. Burnham

Hi-Frequency Systems, Inc.
Vermilion, Ohio

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ THE SHRINKING construction dollar has stimulated new interest in development projects which improve lighting systems and reduce cost. The search for the "better mouse trap" leads to better designed techniques and improved apparatus. Techniques such as the 277/480 volt distribution system, rapid start ballast circuit, large section plastic extrusions and injection molded lighting fixtures are a few of these rays of light which have been engineered into practical reality. Although not yet as widely used as the 277/480 volt distribution system, high frequency fluorescent lighting has now proved itself worthy of consideration as a dollar stretcher.

In the last few years an increasing number of high frequency installations has been put into service providing a wealth of "in service" data to support extensive laboratory test information. Today, high frequency lighting is a recognized possibility for major commercial and industrial buildings. The attraction is threefold—better over-all lighting performance, reduced initial cost, and reduced operating cost. By selecting the best suited high frequency system the installed cost can usually be reduced from 5 to 20 per cent and the operating cost is usually cut 10 to 20 per cent. Even greater savings may be anticipated when these materials are produced in larger quantities.

More light per fixture

One of the major advantages of high frequency is the possibility of operating fluorescent lamps at a higher wattage to give more light without sacrificing lamp efficiency or lamp life below the 60 cycle level. This added flexibility makes it possible to adjust lamp brightness over a wide range and operate lamps at a higher brightness giving up to one-third more light. Three lighting fixtures may provide the same light as four units at 60 cycles.

In addition to the savings in lighting fixtures and lamps, the cost of wiring and hanging lighting equipment can be reduced. This often results in a material savings. In some cases installed fixture costs have been cut in half because of the reduced fixture cost and the fact that fewer fixtures were required.

Comparative installed lighting cost*

	60 Cycle 120/240 Volts	840 Cycle 3 Phase
Lighting equipment		
1. Number of 8′ commercial fixtures in office	90	90
2. Number of 4′ rapid start lamps	360	360
3. Number of 8′ industrial fixtures in factory	426	366
4. Number of 8′ 800 ma rapid start lamps in factory	852	732
5. 840 cycle frequency changer	—	1-30kw, 1-60kw
Electrical load in kw		
1. Lighting load in office	17	11
2. Lighting load in factory	102	76
3. Total connected lighting load	119	87
4. Total connected 60 cycle load	119	99
Material cost		
1. Lighting fixtures and lamps	$ 26,180	$ 14,375
2. Other materials—conduit, wire, panels, etc.	5,648	4,116
3. Frequency changing equipment	—	9,273
4. Overhead and return on materials	4,933	5,760
5. Total material cost	$ 36,761	$ 33,524
Labor cost		
1. Base labor cost for installation	$ 14,128	$ 11,615
2. Overhead and return on labor	6,825	6,450
3. Total labor cost	$ 20,953	$ 18,065
Combined cost		
1. Installed lighting cost from main panel	$ 57,714	$ 51,589
2. Initial savings		$ 6,125
3. Probable savings in operation from lighting and air conditioning power savings and lamp and ballast replacement		$ 1,000 per year

**Comparative cost break-down for a 9250 sq. ft. industrial office and 75,000 sq. ft. factory area illuminated to the same lighting level.*

# of stretching construction dollars

Fixture cost is usually less because ballast cost can be reduced (see Figure 1). At frequencies above 350 cycles, it becomes possible to use a simple capacitor as a fluorescent lamp ballast rather than the transformer-like reactor of the type currently being used in 60 cycle ballasts. Capacitive ballasting nearly eliminates ballast noise and cuts weight to a fraction of its usual value.

A typical capacitive ballast is about the size of a pack of cigarettes and weighs only 3 or 4 ounces. The cost of these ballasts are usually from one-third to one-half the cost of a 60 cycle ballast to operate the same lamps. Long ballast life can be expected since very little heat is developed within the ballast—only a watt or two as compared to 12 to 30 watts for 60 cycle ballasts.

Air conditioning

The simplified ballast arrangement and improved lamp efficiency usually decreases the amount of wasted energy lost in the fluorescent fixture. This is usually around 25 to 30 per cent of the total fixture wattage. This energy, which is dissipated as heat, need not be removed from the occupied area by the air conditioning system.

In some buildings this becomes a very noteable factor, making it practical to reduce the size of the air conditioning unit. This usually happens in multi-story commercial buildings where the lighting load is a large part of the air conditioning load. Air conditioning cost of operation is also reduced since the added auxiliary losses need not be continually pumped out of the occupied area throughout the life of the installation.

A reliable and economical means of frequency conversion is a major consideration in any high frequency lighting system. The motor generator has been used for many years to change frequency. It can be seen in Figure 2 that the cost per kva for this type of equipment is high in small size and comparatively low in large sizes. These units are more susceptible to failure due to the

(Continued on page 123)

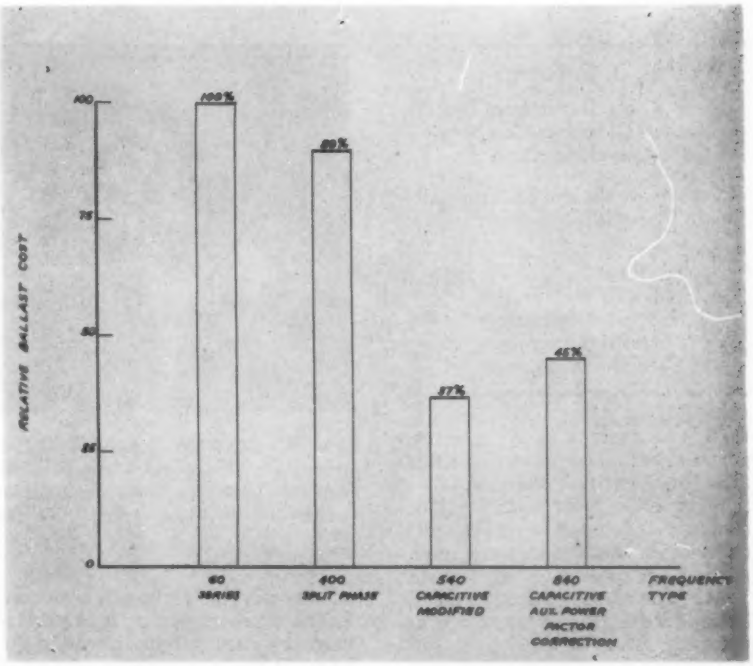


Fig. 1—Relative cost between several types of slimline high frequency fluorescent two-lamp ballasts compared with a 60 cycle series ballast.

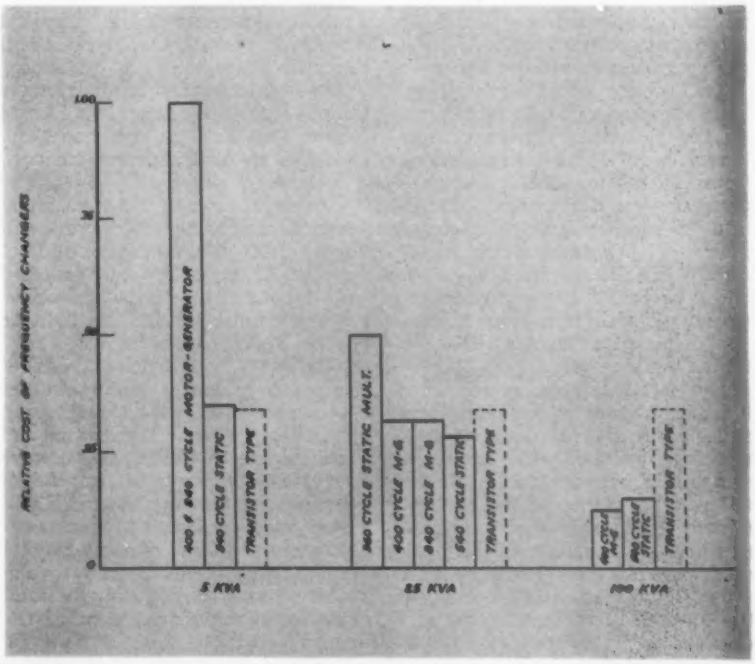


Fig. 2—Relative cost between rotary static and transistor type frequency changers for use on high frequency lighting circuits.

Good lighting today helps sell

By J. L. Tugman
Lamp Department
General Electric Company
Cleveland, Ohio

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
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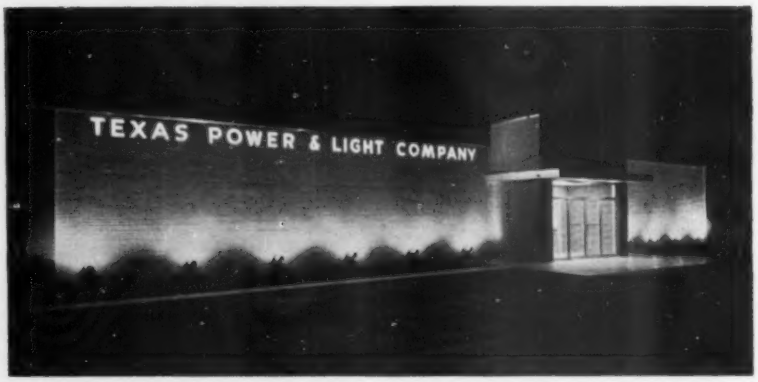
- Consulting Engineers ✓



TEXAS POWER & LIGHT CO. (Waco)—A simple but thoroughly appropriate structural element offers a decorative means for concealing the floodlighting units for this facade. Against the softly luminous expanse of building front, the company sign identifies the property.

◆ GOOD EXAMPLE is the most important influence in rising standards of lighting practice. Good lighting looks best with well designed structures and tasteful decoration. Both the latter are enhanced by quality features in the lighting provision. Throughout the land there is the consciously developing effort by architects and decorators to displace the commonplace and showy with the tasteful and appealing. Integration of light and structure, wherever possible, achieves more satisfying effects year after year as skill in design improves with practice.

The rising prosperity of the South is measured in a large sense by the constantly growing number of good lighting installations. Competition for the consumer's discretionary dollar finds emulation of the tastefully pleasant place of business more potent often than price appeal. Even the daily chore of grocery shopping goes better with background music and display lighting on the vegetables.

The good examples of advanced lighting practice selected for these pages cover a great range of commercial practice. An insurance company's offices, for instance, tell us by a glance at the pictures something about institutional policies on human relations. All business relationships involve some aspects of communication wherein the organization speaks to persons through appearances. Friendliness is one aim of expression through appearances in the variety of office pictures included in the accompanying pictorial selection.

Friendliness, expressed in brightly cheerful interiors, is the basis for good customer and good employee relationships. Cooperation begins where initiative is taken by management to make the physical factors of its place of business visually satisfying. This is also a good way of indicating that the business is progressive and successful. Customers like to come into such quarters, and employees naturally prefer to work in them.

A casual look at the installation examples gathered here will register the general contribution of better lighting. A more studied examination of the illustrations will show how design fits lighting to the service intended.

Lighting for various types of office space varies widely in the treatment for reception rooms, executive offices, recreation and lounge areas. There are always several good ways to provide illumination for any space. These good ways will also represent a choice of budget. A good way to deliver light economically to any kind of interior ought to be well related to other treatment of the space.

Thus, a large general office with strictly functional structural features and equipment, will be consistently served by a strictly functional lighting system. (See the large office of State Farm Insurance Co.) An executive office would require no less functional lighting, but some regard for the individual and the position would suggest more elegance. For the executive who prefers traditional furniture and decoration, the lighting will be different from another who likes the most modern treatment of his office.

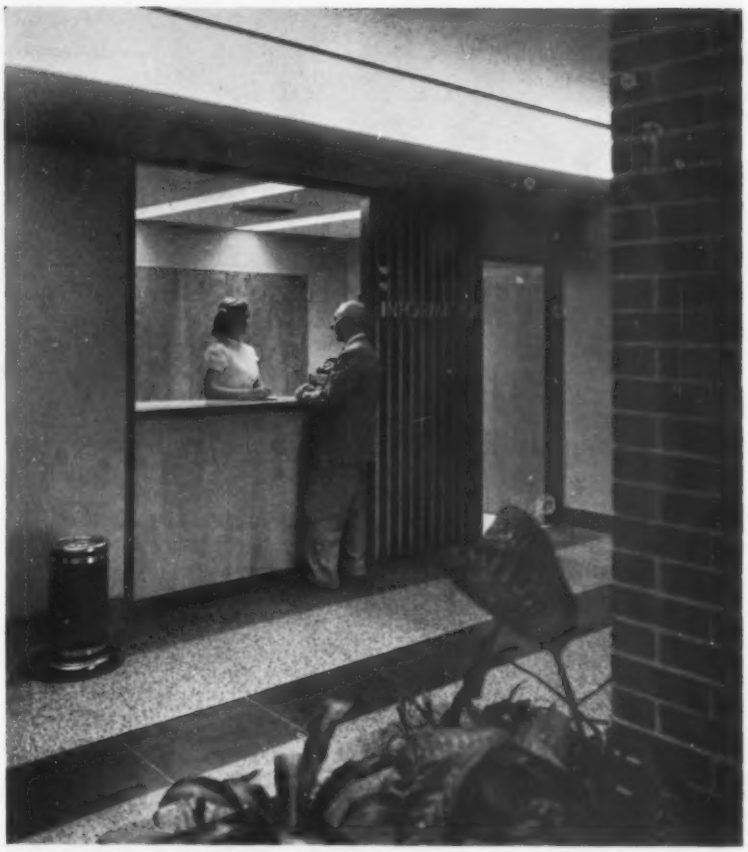
There is infinite design resource in the application of interior lighting. Every type of commercial space can have custom or catalogue equipment specified to its need. Either type can be utilized appropriately to the service desired. More distinction and more regard for appearance demand more special attention to styling.

When the architect or lighting designer undertakes a specific problem, the place at which either will begin is the basic visual demand. There must be sufficient light to see comfortably and clearly whatever tasks the space will involve. At present practice, an advanced installation might call for higher levels than those found in good existing work of five years ago. (The client often seeks to keep ahead of the field.)

This presents an opportunity and a challenge to the designer.

still better lighting tomorrow

SOUTHERN LIFE INSURANCE CO. (Atlanta)—First impressions of a place of business are important. The well appointed reception area speaks for the friendliness of the business to all who call at its doors. This detail view of the information center of a large company is attractive. Structural features, which incorporate the lighting, convey a welcome in the ensemble, which is also distinctive for its pleasantly efficient appearance.



A recreation center for employees (lower right) evokes strong loyalties when it is developed as tastefully as this one. The club-like atmosphere of this space is derived from the character of the over-all design and the quality features of materials. Note how the form of the specially built ceiling member is repeated in the patterned layout of the floor covering. The ceiling member delivers both direct light from the recessed filament units and indirect from the cove on its perimeter.

This main office area is provided with a comfortable atmosphere for a variety of tasks requiring good seeing conditions. There are 45 footcandles, average, here from the rows of fluorescent units spaced 10 feet on centers.

RICH'S STORE (Atlanta) — The women's shoe department (above) makes extensive use of lighted elements in display and visual selling aids. General illumination by filament downlights is unobtrusively effective. They contribute highlights and accent appearance of merchandise as customers try on footwear. Valances and displays suggest extra purchases while patrons are being served.

Women's coats are carefully displayed by lighting expressly designed for this purpose. The suspended fixture over the aisle before the racks provides a generally persuasive illumination. Customers are attracted by this lighting to inspect the selection of coats. Concealed lighting above and below the racks sets off the coats from their background and invites closer inspection. Lighting is offering strong support to self-selling and thereby assisting clerks to serve more customers.

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Here it is . . . a complete line of Asbestos Fixture wire in the same high quality as other well known Carol Cable products.

PRACTICAL PACKAGING • Carol's new distinctive striped carton identifies contents at a glance. Each heavy-duty carton contains the *right* number of spools for the gauge, keeps weight to a practical limit for easier handling.

GAUGE	SPOOLS PER CARTON	APPROX. WT. OF PKG.
18	2	11
16	2	17
14	2	21
12	1	35
10	1	55

COLOR CODED LABELS • Gauge, color and contents show at a glance. Saves time, simplifies inventory. Eliminates costly errors in identification and shipment.

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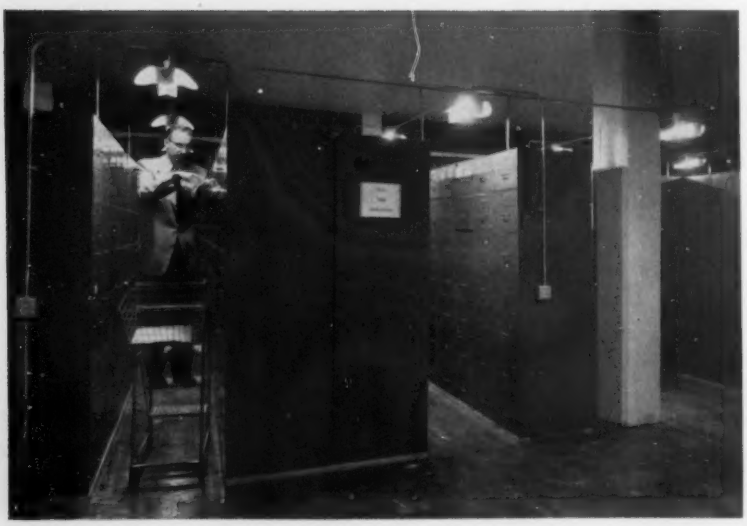
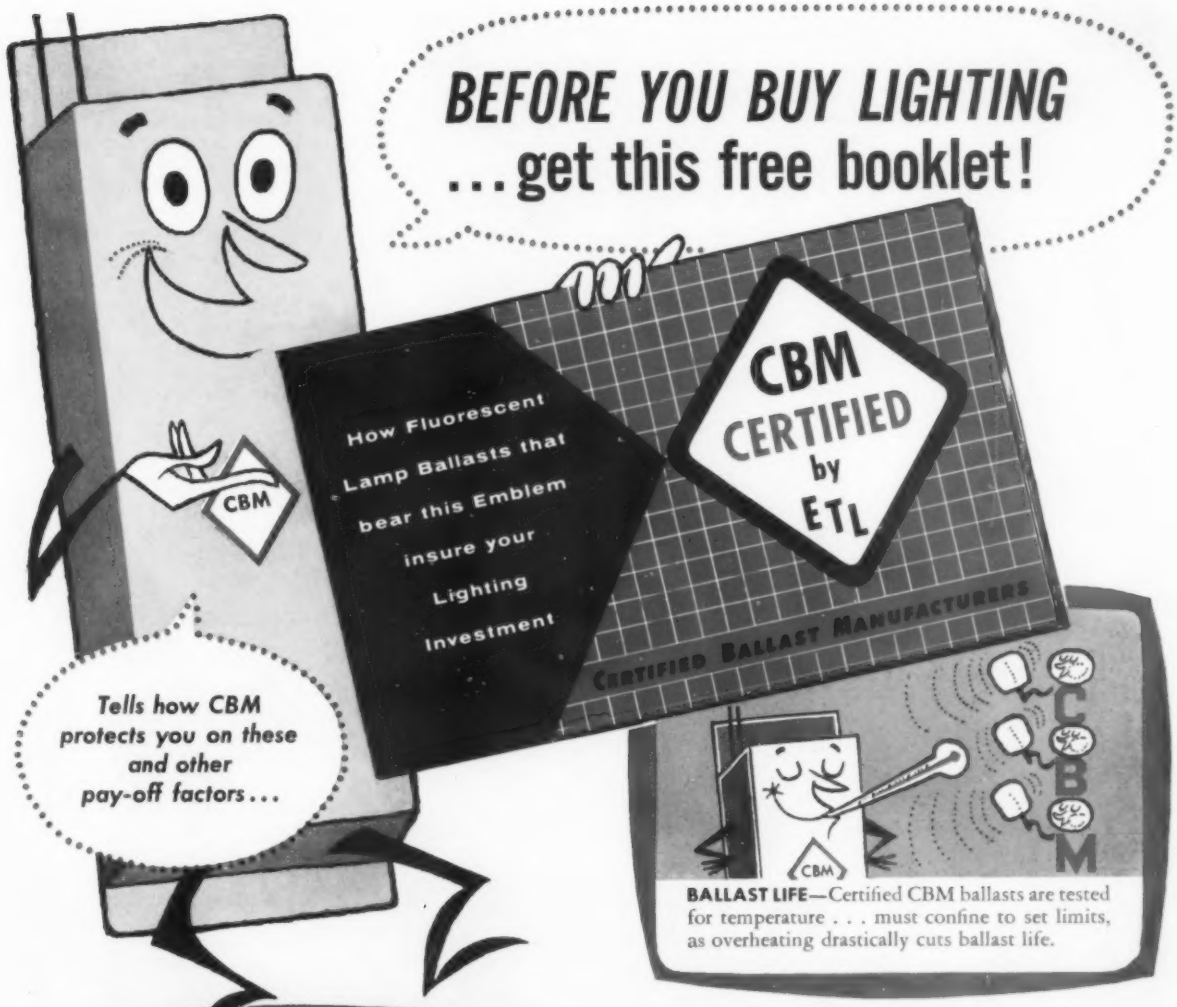
MARY BALL'S CANDIES (Atlanta)—Candy sales in quality shops like this one build up impulse buying with the attractive luminous panel pattern. The ceiling panels contrast the soft quality of the transmitting material with the glinting surfaces of the metal bowls holding filament lamps. Wall panels contrast the luminous area with the texture of squares of wood. Displays and counter lighting complete the luminous merchandising components.

STATE FARM INSURANCE CO. (Birmingham)—Work positions are located so the personnel see the lighting equipment down the length of the rows of fixtures. This provides the most comfortable viewing position with reference to the system. The two-lamp 90T12 units in continuous rows on 8-foot centers, provide ample light.



Records are vastly important in the insurance business. Files are equipped here with specialized lighting fixtures which aid seeing for quick location of file cards.

BEFORE YOU BUY LIGHTING
...get this free booklet!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CBM CERTIFIED by ETL
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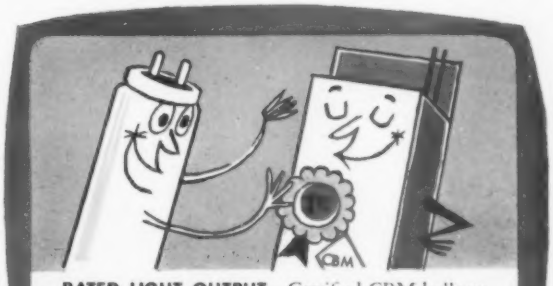
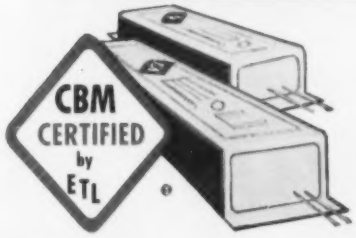
QUIET OPERATION—CBM specifications require a ballast to be well-designed mechanically and electrically, so that it will operate quietly and not create objectionable noise.



RATED LIGHT OUTPUT—Certified CBM ballasts are "tailored to the tube" . . . assure rated light output, steady light, peak lighting performance.



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Participation in CBM is open to any manufacturer who wishes to qualify

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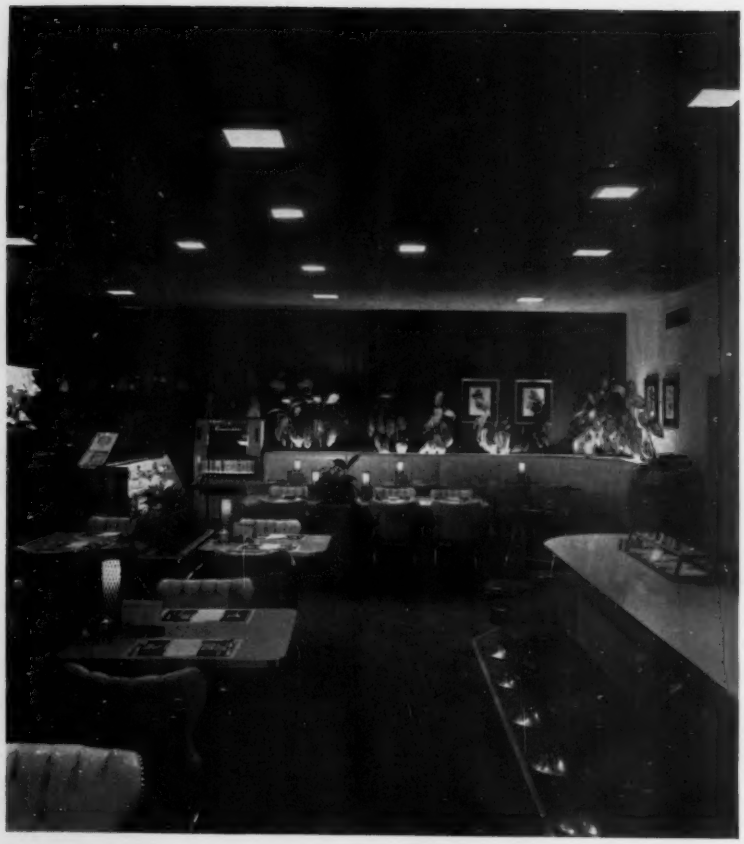
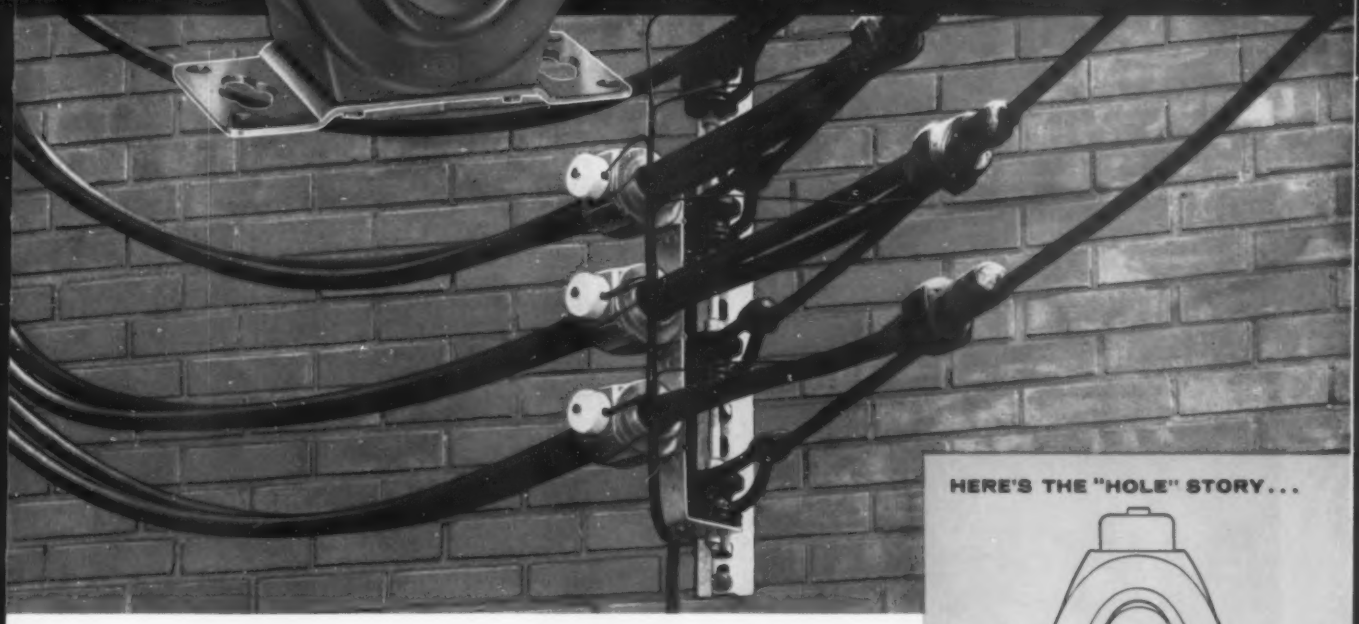


GLASS HOUSE RESTAURANT (Atlanta)—This well-known center for diners-out employs light in several ways to produce the pleasant atmosphere that patrons enjoy. Recessed ceiling units with filament lamps deliver the general lighting. Concealed equipment behind the wall divan lights the planting, decorating the space around the lower wall, and spills light on the wall display pictures accentuating the play of light and shadows. Individual candles on each table adds a touch of luminous color through the glass chimneys.

GEORGIA POWER CO., (Atlanta)—Executive office lighting is keyed to the simplicity of the appointments and the seeing needs of a busy man. Parallel panels of luminous plastic elements deliver soft diffuse illumination throughout the room.

COLOR-CODED
Transformers are encapsulated in colored epoxy resin to readily indicate ampere range.

NEW SANGAMO Type BH* 600 VOLT INDOOR-OUTDOOR CURRENT TRANSFORMER



200-400-600-800 AMPERES

and with new DUAL RANGE 200/400 amp feature

The new Sangamo BH-6 current transformer gives many extra values over previous designs. The *dual range feature* sharply reduces the number of costly transformer change-outs —meets the 0.3 accuracy class on all loads from 20 to 800 amperes. The *oval-shaped window* combines the advantages of both round and obround type—has greatest usable opening of any 600 volt current transformer.

Compact design—more than 40% smaller than smallest similar 200 amp. model, is easier to mount, and is the lightest transformer in its class—only 5½ pounds.

All hardware is of durable stainless steel. Type BH transformers are available in flat-bar and window type construction. Get full details—write for Bulletin 503.

CERTIFICATE OF TEST

A certificate of factory test is supplied with all current transformers. This means that every Sangamo transformer is tested thoroughly before shipment . . . arrives ready for you to put on the line.

*Big Hole

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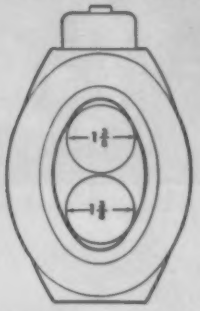
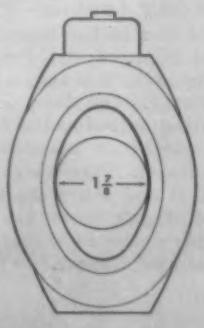
SM58-6

HERE'S THE "HOLE" STORY . . .



Sangamo's exclusive *oval* opening gives greater flexibility in application. It will take two 750 MCM conductors with 600 volt insulation, or . . .

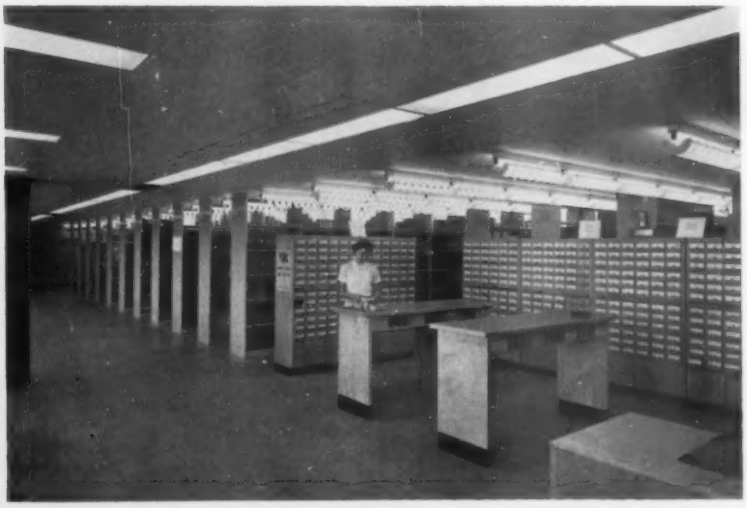


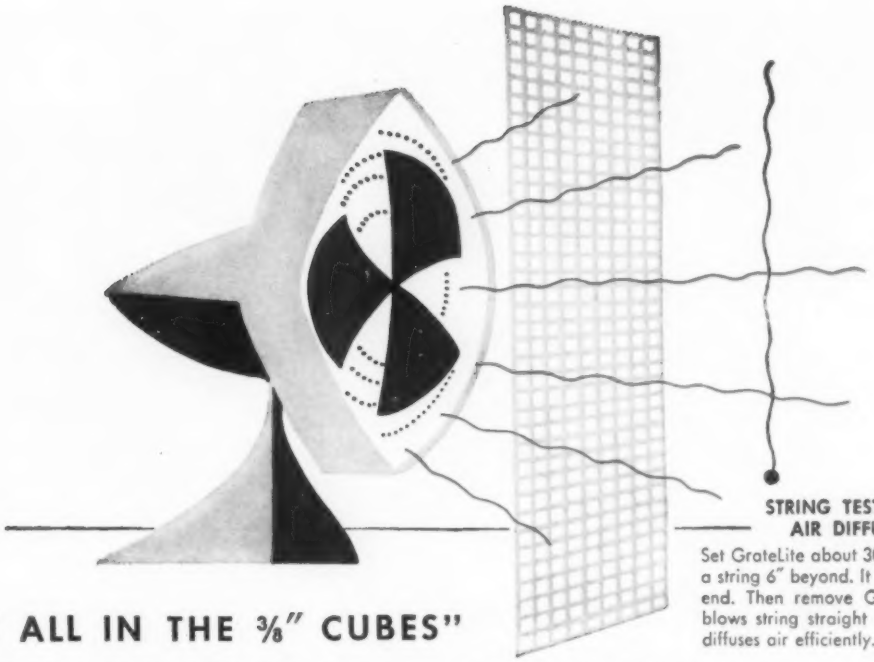
by utilizing the large center of the oval, will accommodate one insulated 1250 MCM conductor.

GEORGIA STATE COLLEGE (Atlanta)—Reception area in this building repeats in the ceiling pattern of lighting equipment the structural emphasis given to the space by the floor covering. Thus, the octagonal center element of the lighting is directly above the dark octagon in the center of the floor. There are 55 footcandles in this area.

Classroom space, which can be divided into smaller units with portable partitions, is equipped with two transverse rows of lighting fixtures for each basic unit. An average value of 50 footcandles is delivered to the students' book on the chair arm.

GEORGIA INSTITUTE OF TECHNOLOGY (Atlanta)—Clean simplicity of line in the layout of the reference room of the Price Gilbert Library gives this area a distinctive appearance. The long line of troffer lighting outlining the aisle leading to the stacks is beautiful as well as functional. Transverse troffers balance it and share the lighting of the aisle. Stack rows are lighted with simply designed louvered sections attached to channel.





STRING TEST PROVES AIR DIFFUSION!

Set GrateLite about 30" from a fan. Hold a string 6" beyond. It ripples from end to end. Then remove GrateLite—and fan blows string straight outward! GrateLite diffuses air efficiently.

"IT'S ALL IN THE ⅜" CUBES"

GUTH GRATELITE CEILINGS ARE GREAT!

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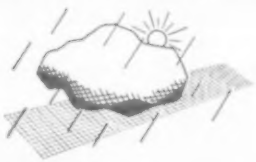
SUPER-COMFORT LIGHTING PLUS AMAZING AIR DIFFUSION

AIR CONDITIONERS USE ITS PRINCIPLE!

Small GrateLite-type plastic cubicles are used on latest model air conditioners to diffuse air efficiently. GrateLite scatters —diffuses AIR!



UNAFFECTED BY HUMIDITY!

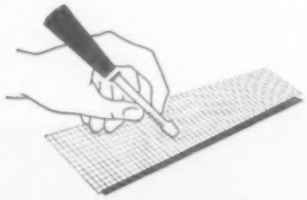
GrateLite is one solid piece—not just glued-together pieces! It is dimensionally stable, and is unaffected by changes in humidity or by high humidity itself. GrateLite is a solid body!

TOUGH AND RUGGED!

You can step on GrateLite . . . it won't mar, crumble or crunch. Its solid tapered vanes are Guth-engineered for maximum strength and ruggedness—important in maintenance!

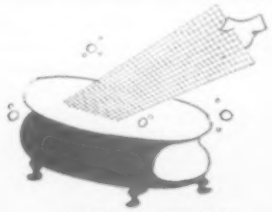
STANDS ROUGH HANDLING!

GrateLite won't bend, buckle or mar when taken down for cleaning and relamping, etc. It won't twist in your hand. Its body and substance are designed for long use.



SCRATCH-RESISTANT!

GrateLite doesn't scar easily—or rip or break when dropped or struck by a tool. Fingernails can't mar its usefulness. No "black eyes," no damaged cubicles to destroy overall beauty and efficiency.



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TRUSTED NAME IN LIGHTING SINCE 1902

* U. S. Pat. No. 2,745,001. Can. Pat. 1957, No. 538,245

New street lighting for the old South

◆ NEW LIGHTING for the old South! That describes the marked change that has taken place in Mobile, Alabama, where a modern mercury street lighting installation has replaced the antiquated units lighting famous Bienville Square.

The historical park in the heart of downtown Mobile has been lighted since 1927 by 32 five-light old-style clusters which carried 2500-lumen incandescent lamps, each mounted on 12-foot cast iron standards. The four streets bordering the Square then were installed with seven single unit 4000-lumen street lights.

Today, all of these antiquated street lights have been replaced with thirty-seven 20,000-lumen color-corrected type JH-1 mercury vapor lamps mounted on twenty-nine 23-foot all aluminum standards. These lights are controlled by a photo electric eye on the bandstand which automatically cuts the system on at dusk and off at dawn.

Illumination in the Square has increased approximately 100 times, and the street illumination has been boosted 25 times over the original installation. The Square is now a place of beauty by night as well as by day, and is also safer at night than it was before the modern lights were installed

The Alabama Electric Company handled the lighting installation for the City of Mobile. Design of the new system was handled by J. G. Pride, division commercial sales engineer, together with A. C. Reed and J. E. Springer, commercial sales engineers. The luminaires were supplied by Philadelphia Electric Mfg. Co.; the aluminum standards by Pfaff and Kendall.

"We used 40,000 feet of SPANG HD Conduit for the Rubberoid Felt Mill," states Mr. Dotson.' "That's a good test for any conduit; and believe me, SPANG HD is tops. It's the easiest conduit to work with we ever installed."

"SPANG HD IS THE EASIEST-TO-WORK-WITH CONDUIT WE EVER USED"

says Mr. Bill Dotson, Sr., Dotson Electric Company, Savannah, Ga.

"We installed over 40,000 feet of SPANG HD Conduit in the new Rubberoid Felt Mill in Savannah. SPANG HD was easy to work with—easy to thread and bend. It is the fastest conduit to install we have ever used.

"The SPANG HD galvanized finish was excellent. Its ability to withstand outside storage for long periods of time was very good. Several of the inspectors of the finished conduit installation remarked on its shiny finish and clean appearance."

GET TOP QUALITY EVERY TIME WITH SPANG HD

That's because SPANG HD galvanized conduit is produced under quality-control conditions from skelp to finished product and inspected thoroughly to assure you a top-quality, uniform product. Try it once, and you'll use SPANG HD regularly. See your local SPANG Distributor for your next order.

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General Contractor: Daniel Construction Company, Jacksonville, Fla.
Electrical Contractor: Dotson Electric Company, Savannah, Ga.
SPANG Distributor: Wesco, Savannah, Ga.

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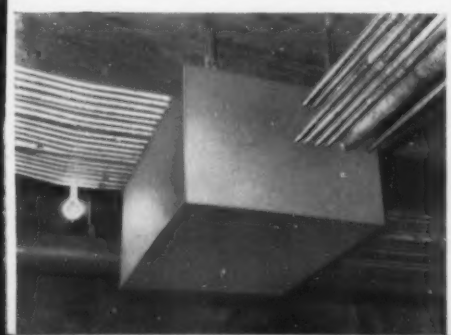


The "Fashion Plate" wall switch is a homemaker's dream. It's easy to locate and easy to operate.

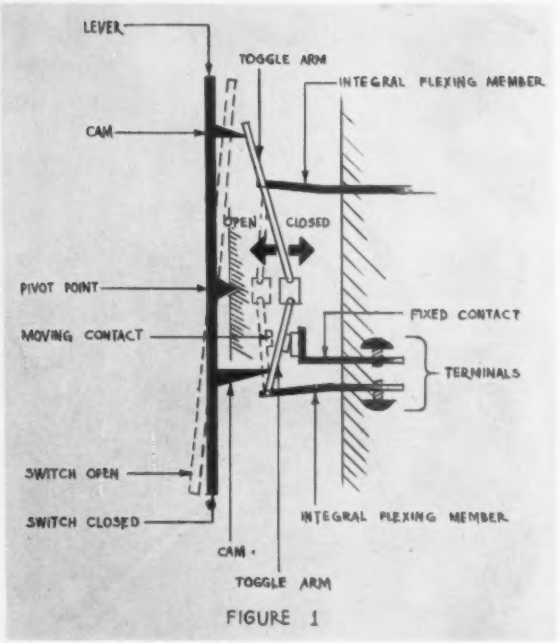


FIGURE 1

To close contacts press lightly on the top of the actuator. To open contacts press on the bottom.

Fashion plate switches have new look

By R. O. Wiley
Design Engineer
Bryant Electric Company
Bridgeport, Connecticut

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ A NEW WALL SWITCH that combines form and function in a most unusual manner will shortly be on the market. The significant changes in styling and operation will thrill decorators, delight homemakers, and excite electrical contractors.

The Fashion Plate wall switch is revolutionary in styling. In place of the customary bevel-edged, rectangular wall plate is a straight-sided, rectangular wall plate that frames a large actuator. One has only to touch the top of the actuator lightly for "on" and the bottom for "off."

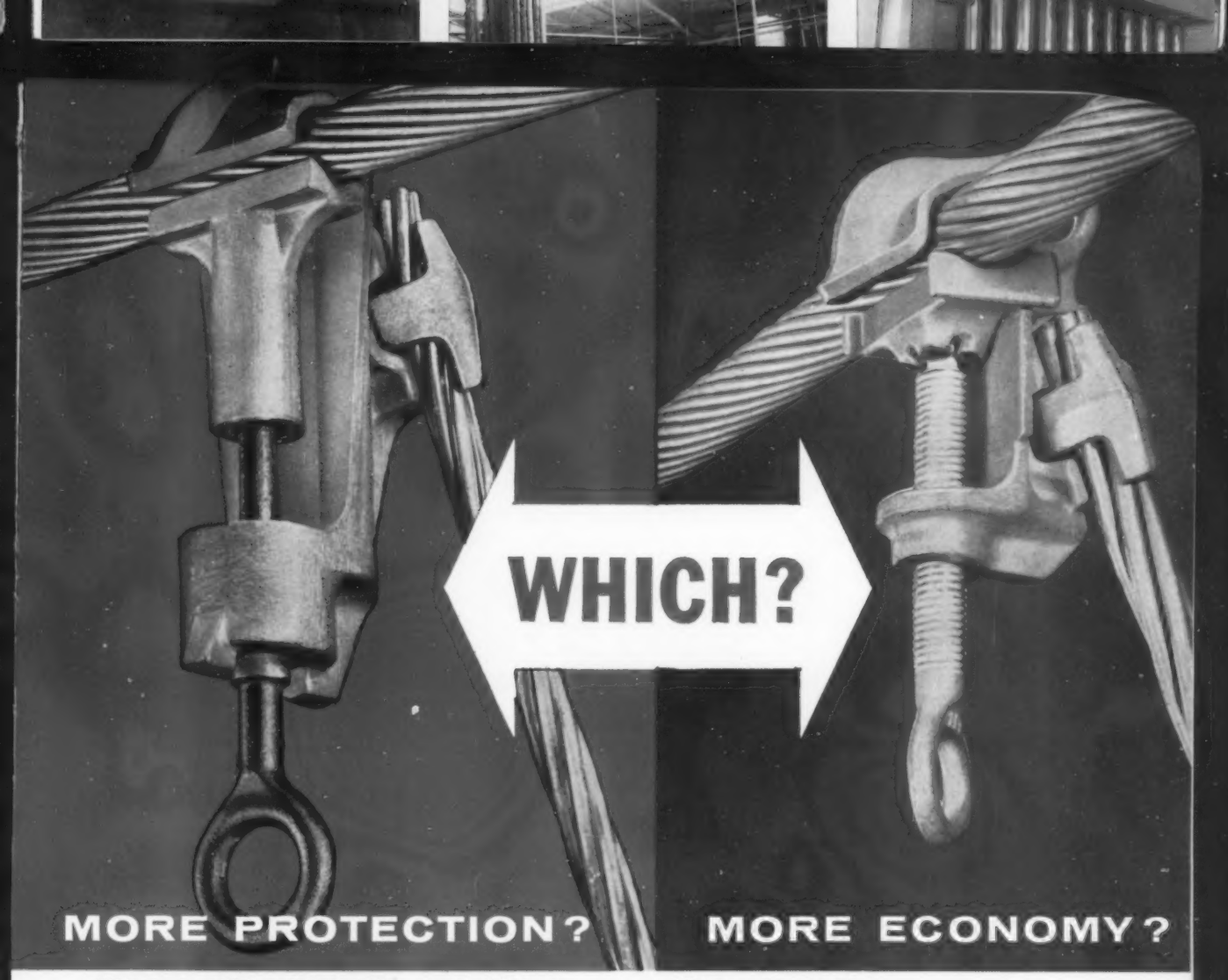
Equally revolutionary in the Fashion Plate switch is the internal mechanism, the design of which does not rely on the use of coiled springs or special spring alloys. As shown in the diagram, uniqueness of the functional design lies in the modification of a toggle joint to operate as an over center mechanism by applying force to the toggle arms instead of to the center pivot. The force that supplies pressure to the silver contacts and pressure for position indexing is obtained from two of the current-carrying terminals that have integral flexing members. The compressive force of these integral flexing members is transmitted through the toggle to the silver contacts through a knife-edge bearing on the outer end of each of the toggle arms. A notched, nylon block functions as a center pivot for the toggle joint and simultaneously electrically insulates the toggle arms from each other.

The toggle arms are moved down or up by a lever that rotates seesaw fashion about a fixed center support. Apply force to one end of the lever and a cam-like projection on the underside presses down on one toggle arm inside the knife-edge bearing point, causing the toggle to move to the closed position. Apply force to the opposite end of the lever and a similar cam-like projection presses down on the other toggle arm, but this time outside the knife-edge bearing point, causing the toggle to move to the open position. The switch is "closed" when the toggle moves in the inward direction and "open" when it moves outwardly.

Wiring terminals

Unusual simplicity and convenience have been designed into the wiring terminals. A curved nut is provided that will clamp securely one or two wires, solid or stranded, up to #10 AWG. Only the curved nut moves when the washer head screw is turned as the head is held captive. This assures an unobstructed wire opening.

The single-pole and three-way switches are provided with a



(HLP Enclosed Thread Spring Compensated Clamp: 4 clamps — #6 solid to 636 MCM ACSR)

(HL Open Thread Clamp: 5 clamps — #8 to 1431 MCM ACSR)

Now...Two New Hot Line Clamps

Take your choice of Anderson's two new series of hot line clamps: the extra protected HLP, or the economical HL. Both come in cast aluminum or plated aluminum, and both have basically the same rugged, long-life features: (1) Large area, high pressure main and tap contacts on the same casting for full current flow, low resistance. (2) Massive plated bronze eyebolt terminals, designed to pass the Mercurous Nitrate Test, insure protection from season cracking and stress corrosion. (3) Extended "duck-bill" upper contact and deep cable seat make quicker installation, prevent cable "walk-off" during installation!

HLP "extras" are a heavy duty, Vanadium Steel-plated multi-coil spring and a threaded, permanently inhibited chamber to assure an arc-proof and corrosion-proof eyebolt stem. Completely housed in the main casting but away from the current path, the spring compensates for cable cold flow, temperature changes, relaxation, heavy fault currents. Much higher contact pressure with the same eye-stem torque results from the new in-line pressure mechanism. So, take your pick. Both the HL and HLP do the job, are simple to install, and ruggedly built for extra long life.

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"feed-through" terminal that, being electrically insulated from other live parts, provides a junction for splicing the through wire in the switch box. To make a splice, the two stripped ends of the through wire are inserted under the curved nut and the washer head screw tightened.

The Fashion Plate switch is available in 15- and 20-ampere ratings for use on alternating current where the voltage ranges from a nominal 120 volts to 277 volts. It can be used at its rated capacity to control incandescent lamps, resistance heaters, and inductive devices such as ballasts for fluorescent lamps and at 80 per cent of its rated capacity for motors. The silver alloy contacts combine with a quick make and a slow break to give the new switch a life many times in excess of the requirements of the Underwriters Laboratories, Inc.

Standard wall boxes

The Fashion Plate switch is made to mount in standard wall boxes. Wall plates and actuators are available for mounting singly, or in two- or three-gang combinations. After the switch is installed in the wall box, the wall plate, with an opening to match the actuating lever, is snapped into place. It is held tightly in place by spring members integral with the switch mounting yoke. If desired, the wall plate may be secured by screws to the yoke. The actuator, having integral pins, fits into a recess in the wall plate. The pins are forced into matching holes in the actuating lever where they are held firmly in place by the pressure of wire spring clips.

Present plans call for the wall plate to be black or white and the actuator to be molded of opaque ivory plastic or of clear plastic. The latter can be painted on the underside or backed up with wall paper. This flexibility makes possible matching the Fashion Plate switch to the decor, or of using it as a decorative highlight.

Economic comment

(Continued from page 4)

tivity. The unsettled conditions of an election year always tend to slow the tempo of business activity until the results are known. Thus, although most signposts are pleasant to read at this point, no real increased activity in economic life should be anticipated until the uncertainties are left behind.

Maintaining industrial electronic apparatus

By George C. Skinner
Static Control Engineer
Westinghouse Electric Corp.

This article should be especially helpful to the following readers:
Electrical Contractors ✓
Electric Utilities ✓
Electrical Wholesalers
Electrical Inspectors
Industrial Engineers ✓
Consulting Engineers

◆ *This is a continuation of the discussion on this subject which began in the September issue of Electrical South.*

Testing ignitrons

For ignitrons try a new tube first, to put the machine in service quickly. Remove the tube from the control and test the tube in a Westinghouse tube tester to see whether it is gassy. If no tester is available,

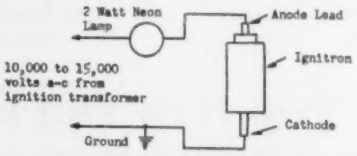

Fig. 10—Gas Test for Ignitron Tube

mount vertically with anode lead up and connect as shown in Fig. 10. If neon bulb glows, tube is gassy.

Important: The ignitron must have been inoperative for at least four hours before test. If the tube does not prove to be gassy, remove the power from the ignitrons, remove the ignitor lead and measure resistance between ignitor and cathode of tube with an ohmmeter. If resistance is less than 5 ohms or

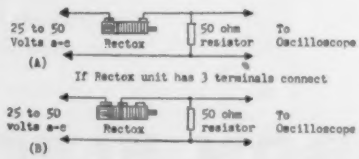

Fig. 11—Test of Rectox

greater than 100 ohms, the tube is defective.

Testing rectox rectifiers

Rectox Rectifiers can be checked by connecting the Rectox as shown in Fig. 11A. If the Rectox unit has 3 terminals, connect as shown in Fig. 11B. Check each section of three-terminal Rectox by moving input lead from one end of Rectox to the other after one section has

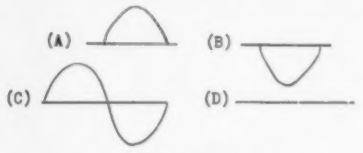

Fig. 12—Test of Rectox

been checked. The wave form should be as shown in Fig. 12A. If it is as shown in Fig. 12C or 12D the unit is defective. If an oscillo-

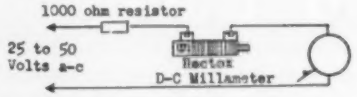

Fig. 13—Test of Rectox

scope is not available, connect as shown in Fig. 13. Ammeter A should read at least 0.010 ampere. A three-terminal Rectox unit may be checked in similar manner. *Caution*: Rectox must be removed

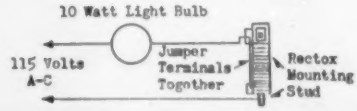

Fig. 14—Ground Test of Rectox

from the circuit before testing. To ground test a Rectox connect as shown in Fig. 14, if the bulb lights the unit is defective.

Testing metallic rectifiers

Ignitron tubes may be controlled by Thyratron firing tubes or by metallic rectifiers. When a tube is suspected of being defective, it may easily be checked by inserting a spare. This same procedure may be used to check a firing rectifier, but

Tube mill operator here keeps close watch as he adjusts weld heat on control console.

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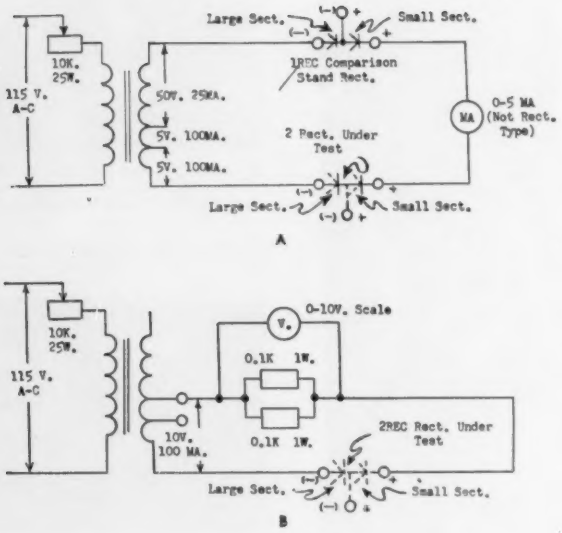

Fig. 15—Copper-Oxide Rectox Test

1 REC—Rectox (This should be a new Rectox which is known to be good since it functions as a comparison standard).
2 REC—Rectox under Test
MA—0.5 MA Meter (Must be dynamometer type. Rectifier type commonly used in multi-test meters will not work.)
V—0-10V. Meter with 1000 Ohms per Volt Movement or Higher.

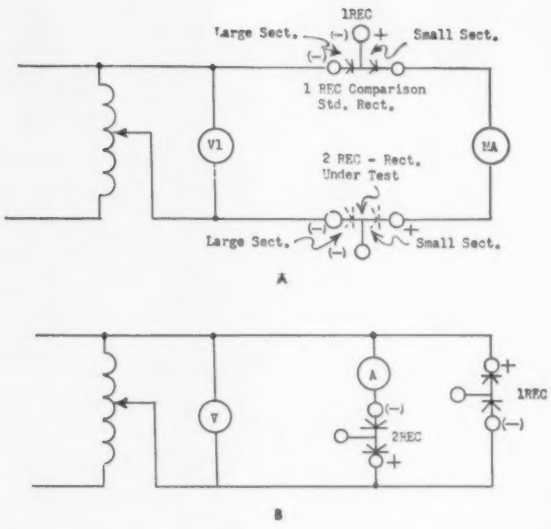

Fig. 16—Selenium Rectox Test Circuit

1 REC—Rectifier (This should be a new rectifier which is known to be good since it functions as a comparison standard.)
2 REC—Rectifier under Test.
MA—0-500 ma DC Meter
V1—0-300 volt AC Meter
V2—0-30 volt AC Meter
A—0-1 amp DC meter

frequently no spare is available and it is desirable to check the unit in question. A simple, reliable procedure may be used, but the tests will vary for copper oxide and selenium rectifiers. Tests for proper back resistance, shorted cells and forward resistance of a copper oxide rectifier.

1. With IP set at maximum resistance, insert the rectifier to be tested as shown in Fig. 15A and apply the power.

Decrease IP to O resistance slowly, watching meter "MA" to see that the meter does not read off scale. If the meter reading exceeds the value shown in the tabulation "Test #1" the back resistance is low and the component defective.

2. "If Test #1" is satisfactory short out the small section of the rectifier with a jumper. The current through MA should rise to minimum figure indicated on the tabulation as "Test 2".

3. Repeat 2 except short out the large section of the rectifier and refer to tabulation "Test 3" for the minimum increase in current.

4. Connect the rectifier as shown in Figure 15B. With R1 at maximum resistance, apply power. Now decrease IP slowly to minimum resistance observing the voltmeter to see that the reading does not go off scale.

CURRENT AND VOLTAGE TABULATIONS

Test No.	Reading	
1	Back Resistance Current Maximum.....	.30 ma Max.
2	Short Cell Test (Small Section) Minimum increase in test 1 current.....	.5 ma
3	Short Cell Test (Large Section) Minimum increase in test 1 current.....	1.85 ma
4	Forward Voltage Minimum..	1.8

If any one test fails the rectifier is defective and there is no point in continuing the test procedure.

Tests for proper back resistance, shorted cells and forward resistance of a selenium firing rectifier.

1. With the variac set for minimum voltage output, insert the rectifier to be tested as shown in Figure 16A. Short out the large section of both rectifier stacks and apply power. Increase the voltage until 99 volts RMS is read on the voltmeter. If the reverse leakage exceeds 120 ma after the voltage has been applied for 5 minutes the unit is defective.

2. With the variac set for minimum voltage output and the small section of both rectifier stacks shorted out (the large section in the circuit) apply the power. Increase the voltage until 264 volts RMS is read on the voltmeter. If the reverse leakage exceeds 120 ma after the voltage has been applied for 5 minutes, the unit is defective.

3. With the variac set for minimum voltage output, insert the rectifier to be tested as shown in Figure 16B. Apply the power and increase the voltage until .6 ampere is drawn from the rectifier. If the voltage drop exceeds 27.5 volts, the unit is defective.

Look for all causes

While it is not the purpose of this article to discuss other electronic maintenance activities, we would like to sum up with one final note of caution to the maintenance man. When a circuit fails to operate, don't immediately assume the trouble lies in the electronic components. Many maintenance man hours are needlessly spent each year because the repair man failed to look for simple mechanical trouble first. For example, a clogged water filter in a water cooled system is often overlooked in the search for the "electronic failure". Always make certain where the trouble is, then start testing when it is necessary.

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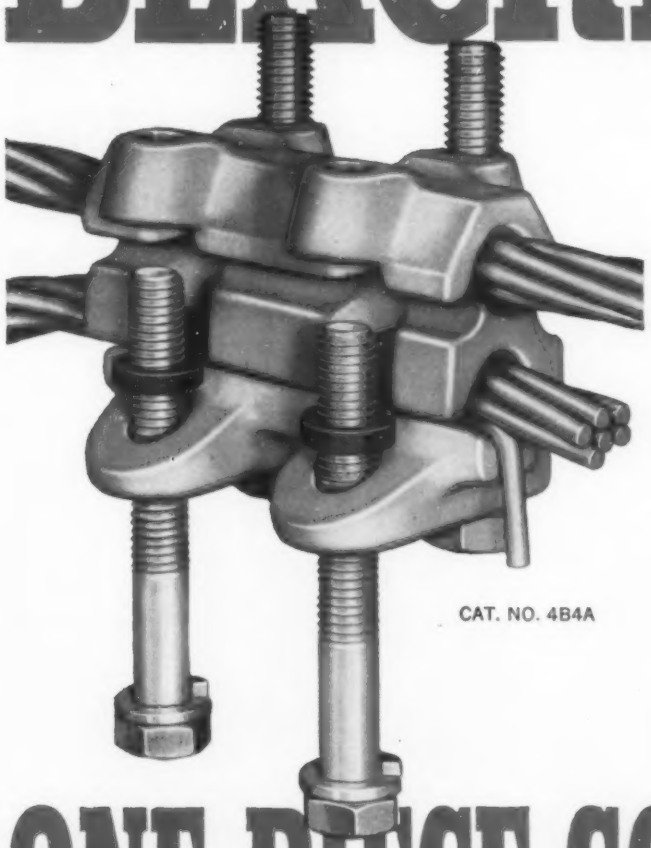

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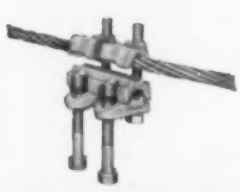
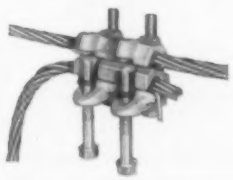
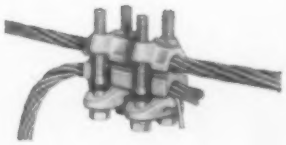


Unscrew the two free bolts contained with neoprene washers and hang over main.



Insert tap wire.



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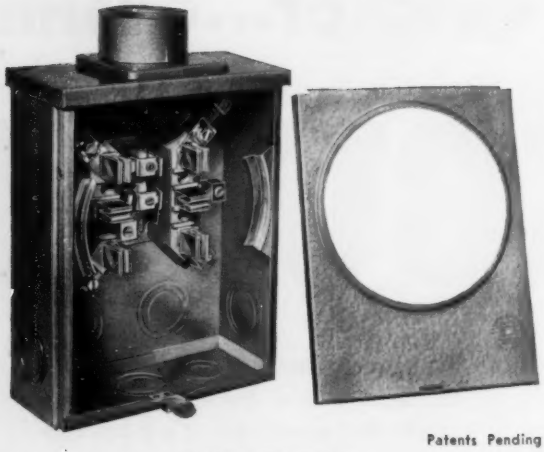

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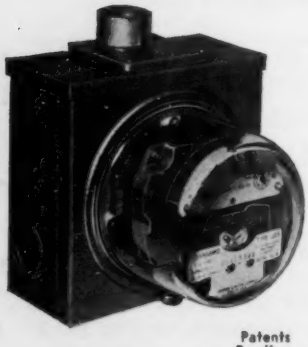

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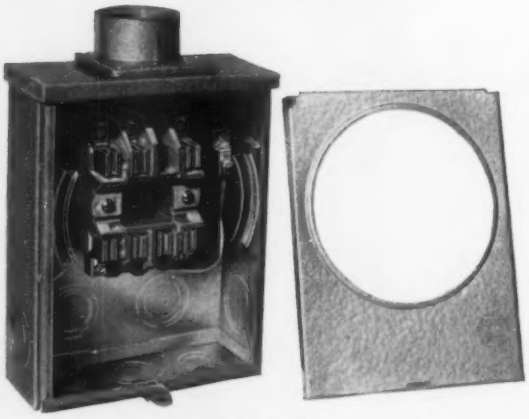

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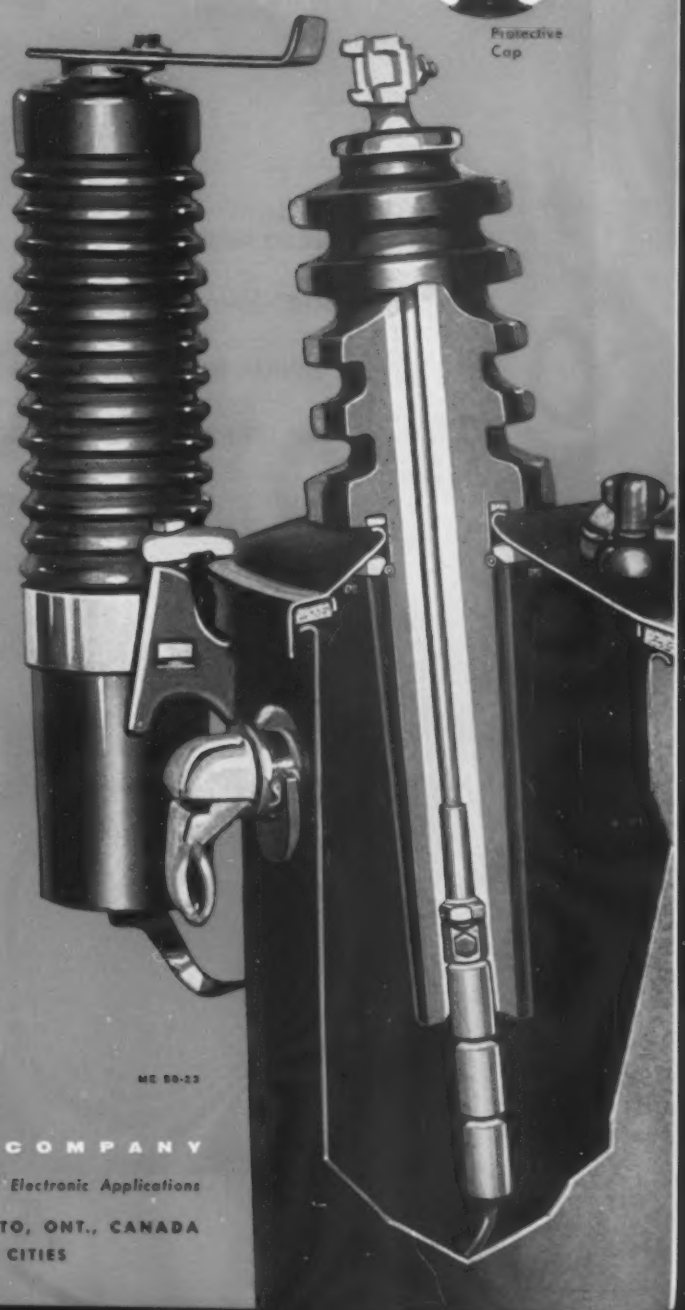
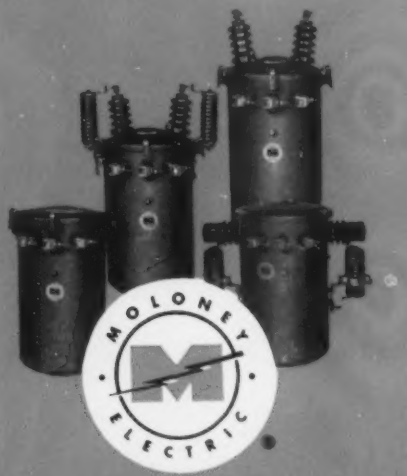
- CSP Transformers with a high voltage above 5 KV have the protective fuse mounted in the bushing. Fuse is easily replaced through the handhole.
- Protective caps are provided for cover mounted bushings.

These improvements result from Moloney's continuous research and development programs which have as their goal the improvement of all types of transformers.

Take advantage of Moloney's more than sixty years experience in the design and manufacture of transformers . . . Specify Moloney Tranformers . . . All Along the Line.

Protective Cap





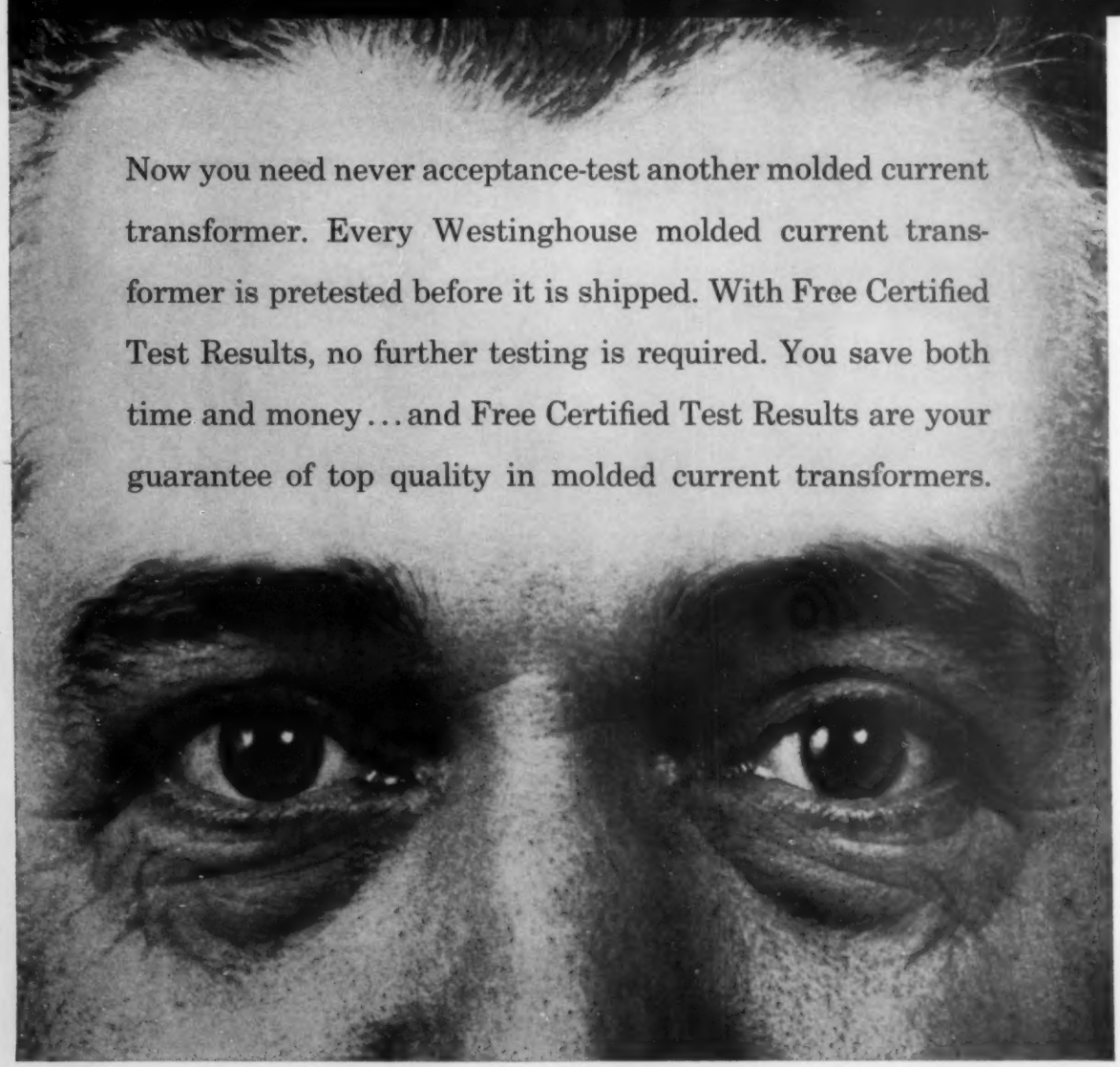
MC 59-23

MOLONEY ELECTRIC COMPANY

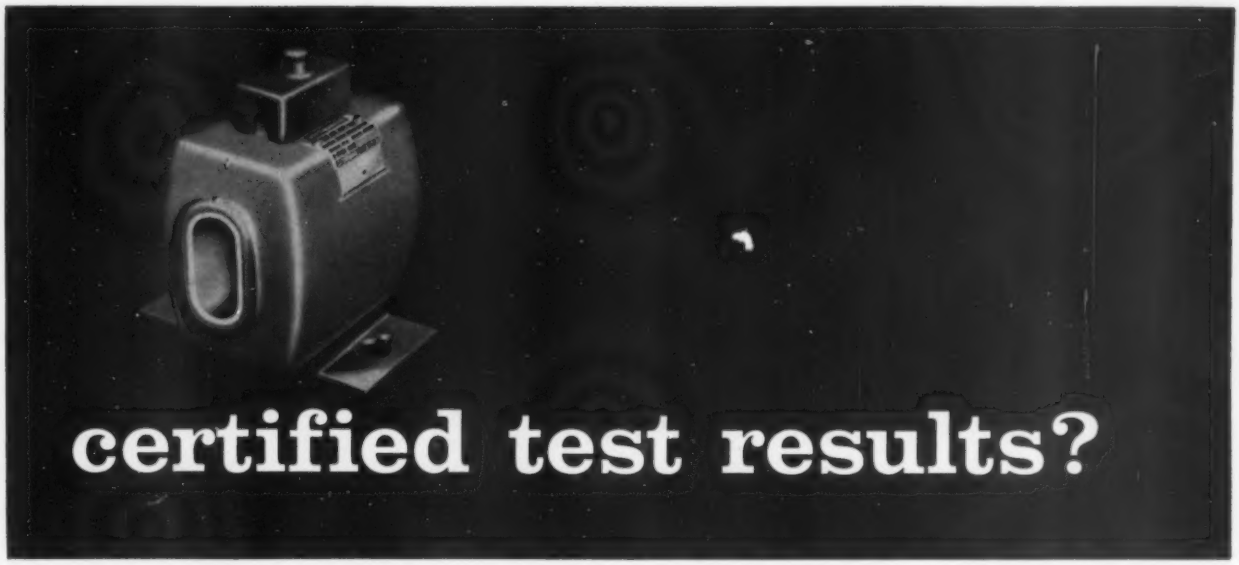
Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA
SALES OFFICES IN ALL PRINCIPAL CITIES

are you among the 88 utilities saving money with free



Now you need never acceptance-test another molded current transformer. Every Westinghouse molded current transformer is pretested before it is shipped. With Free Certified Test Results, no further testing is required. You save both time and money... and Free Certified Test Results are your guarantee of top quality in molded current transformers.



certified test results?

Eighty-eight utilities across the country have discovered the time- and money-saving plusses of Free Certified Test Results. Here's what some of them say:

". . . a fine idea, and we will take immediate advantage of it. This will eliminate testing in our central division and reshipping; it will save us between $2 and $3 per unit."

"We have tested your EMR and verified results with your Certified Test cards. We are informing our divisions that testing of Westinghouse current transformers is no longer necessary."

"The Certified Test has made it possible for our company to eliminate the expense of shipping these transformers into a central laboratory for testing, then reshipping them to each of the District offices as required. Shipments can now be made direct to the area where they are to be installed."

"It is no longer necessary to test Westinghouse EMR and EMO transformers — a real savings for our company . . ."

Company Number_____

TYPE EMR CURRENT TRANSFORMER CERTIFIED TEST DATA

Serial Number	5.7A	275 56
Nameplate Ratio		200/05
Date of Test		11 14 57
Insulation Test Results		T000 00
Phase Angle And % Ratio — 100 % Current B 0.2 Burden	1.6+	100.10
Phase Angle And % Ratio — 10 % Current B 0.2 Burden	0.3+	100.25

(See reverse side for interpretation of data)

The above is a true record of actual tests made on this unit at the Sharon Works of the WESTINGHOUSE ELECTRIC CORPORATION.

Luis W. Yoshum

"Our actual test results on all 48 EMR transformers confirmed the accuracy of your Certified Test report within 1/10 of 1%."

". . . a good idea . . . will save real money for us."

"Our operating department has recommended that we stop testing and accept your molded line as received."

"Your Free Certified Test Results . . . will save us $3.50 per transformer . . ."

". . . a definite advantage and a cost-saving extra in current transformers."

"This is the best thing that has happened in instrument transformers in a long time."

THEY ALL HAVE IT...

All Westinghouse molded current transformers carry the Certified Test Results record. This includes the SM line, molded of silicone rubber, and the 600-volt class, molded of polyester elastomer, a product of Westinghouse research.

Is your company among the 88 saving time and money with *this* Bonus Value? Free Certified Test Results are another example of the Bonus Values made possible through Westinghouse earnings reinvested in research and development. J-70893

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Automatic carousel testing minimizes possibility of human error. Test results are printed on a 3 x 5 file card. This accurate record is given you for your files — another plus from Free Certified Test Results. This test data should satisfy your state PUC requirements.

USS Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

Even under the toughest working conditions—

Amerclad

puts power where you want it!

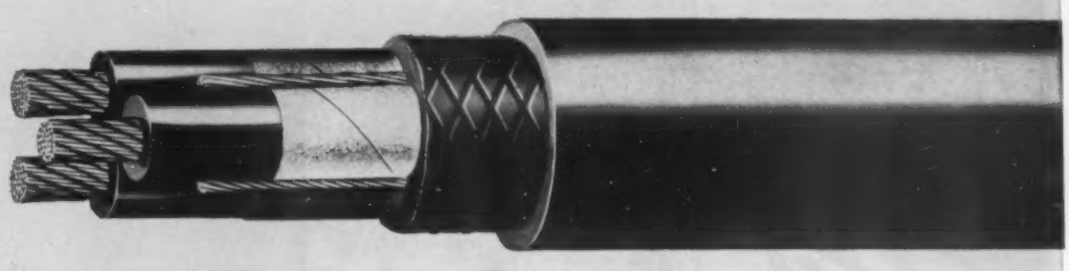
Of all the machines and equipment on your job, none is subjected to more gruelling treatment than portable power cable. And none demands less attention. You reel it out, connect it up . . . and forget it. *That is, if what you are using is Tiger Brand Amerclad.*

For Tiger Brand Amerclad Portable Power Cord and Cable is made *extra* strong and *extra* tough to withstand the worst that man and the elements can dish out. Constant exposure to sun, rain and snow have little or no effect on it; you can drag it over and around sharp rocks, through mud and wet concrete; even run over it with heavy trucks—all without damaging its tough hide.

Tiger Brand Amerclad Cord and Cable consists of flexible, rubber-insulated conductors encased in a tough, resilient protective jacket of Amerprene, an oil-resistant compound of extreme density and toughness that is both moisture-proof and fire-resistant.

For more information, get in touch with your American Steel and Wire salesman. Or write direct to American Steel & Wire, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand, Amerclad and Amerprene are registered trademarks



American Steel & Wire Division of USS **United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

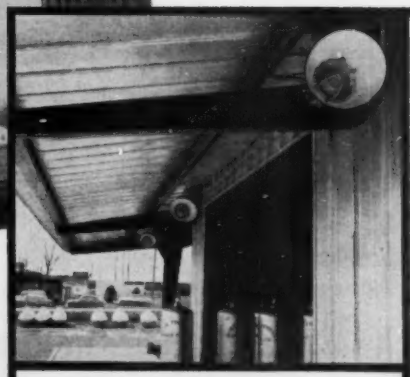
Chemical Manufacturers KILLARK

Bottled Gas Co. Safety-proofed with Rugged, Non-sparking Killark Fittings and Fixtures

The bottling and handling of propane gas requires care and caution every step of the way—including safe, spark-free electrical fittings and lighting fixtures for the areas that are to serve it. To fill the need for quality-you-can-count-on fittings, the Ruby Propane Gas Co. of Effingham, Ill. chose the Killark line for installation throughout their plant.

Electrical Contractor:
Lawrence Dust Electric Co., Effingham, Ill.

Killark Representative:
Ralph Hinchman, St. Louis, Mo.



Two scenes of the Ruby Propane Gas Co. loading dock, safely lit for night use with Killark Explosion-Proof fixtures.

In the background of this close-up of a tank of propane gas stand several Killark "sentinels of safety": Killark explosion-proof switches, explosion-proof receptacle and a seal-off fitting.

See Killark Booth 314

National Association Electrical Distributors Convention

Killark

KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

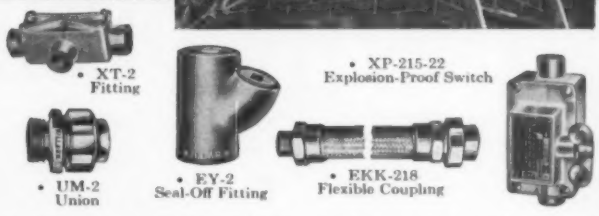
Vandeventer and Easton Aves. St. Louis 13, Missouri

Specify the Safety of EXPLOSION PROOF FITTINGS

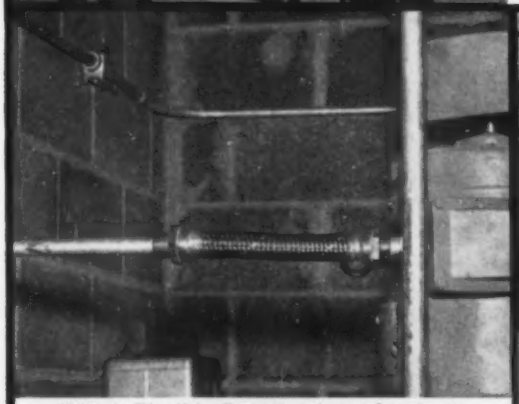
Hazardous Plant Area Protected by Killark Fittings and Fixtures—Strong Alumalloy Construction . . . Rust and Corrosion Free.

Because the E. F. Houghton Company of Detroit, Mich. manufacturers special chemicals, including oils and greases, the interior plant area requires explosion-proof electrical fittings. The Killark line of Alumalloy fittings was specified throughout the job . . . a tribute to Killark design for safety . . . strength . . . long life . . . and good looks.

Electrical Contractor: Sarin Electric Co., Detroit, Mich.
Killark Representative: Reicher Elec. Sales Co., Detroit, Mich.



Mr. Vic Sarin of Sarin Elec. Co., looks on as a member of the E. F. Houghton Co. points to several Killark fixtures used to connect a pump installation.



Killark Flexible Coupling is used to hook up motor installation.

Killark Explosion-Proof fixtures now provide ample, safe light throughout the plant. They feature adequate ventilation for cool, efficient operation . . . can be relamped in seconds without tools . . . have a rugged body to contain internal explosions.

KILLARK REPRESENTATIVES

ATLANTA—Ernest T. Loyd, Inc., 69 Mills St., N. W., Atlanta 8, Georgia
BALTIMORE—Leo T. McCourt Co., 11 West 25th St., Baltimore 18, Maryland
CINCINNATI—Arthur L. Ehlers Co., 1031 Meta Drive, Cincinnati 37, Ohio
DALLAS—Geo. E. Anderson Co., 1901 Griffin St., Dallas 2, Texas

Pennsylvania's Turnpike... Model for Modern Motoring

WIRE BY PHELPS DODGE

When the Pennsylvania Turnpike opened in 1940, it was the first modern highway of its kind in the East. Since then, it has earned a reputation as a model super-highway whose design combines a free flow of traffic with a low accident rate.

One of the requirements for the Turnpike tunnels, interchanges, approaches and portal buildings was an electrical system of the highest quality. That's why Phelps Dodge building wire and rubber insulated, neoprene-jacketed cable was installed. For 18 years, this wire and cable has been giving the Turnpike dependable, trouble-free service.

On every wiring job where top-quality performance, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge distributor!*

PHELPS DODGE COPPER PRODUCTS CORPORATION

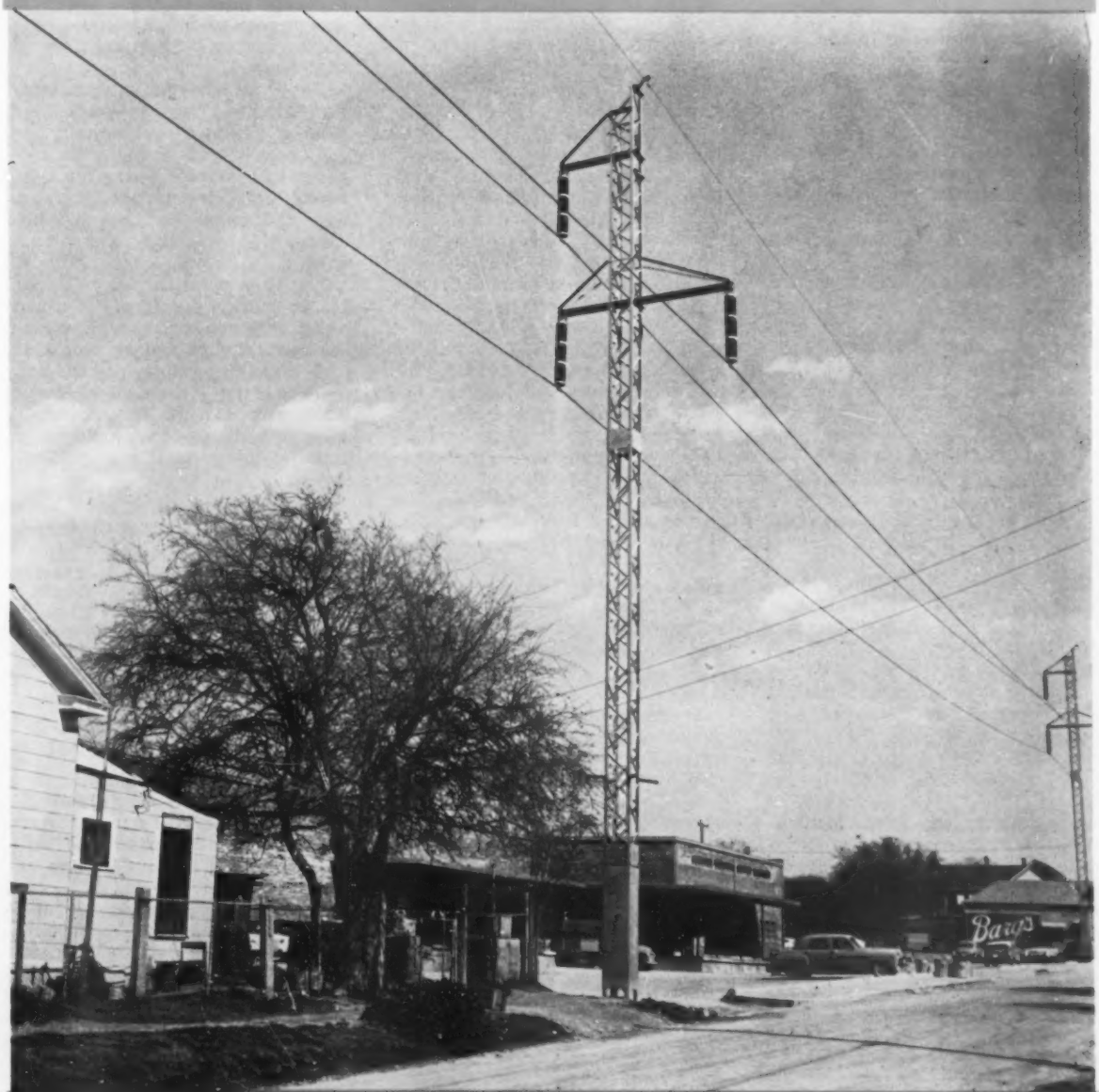
SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

UTILITY ENGINEERING

Transmission — Distribution — Metering

Design
Installation

Testing
Maintenance



TRANSMISSION LINE ECONOMY—These narrow base towers are being used in congested areas in place of expensive underground construction.
(See next page)

Narrow base steel towers transmission right-of-way

By H. C. Hughes
Engineer
Transmission and Coordination
City Public Service Board
San Antonio, Texas

◆ THE ACQUISITION of right-of-way for transmission lines is rapidly becoming a major problem for many electric utility companies. The City Public Service Board of San Antonio, Texas, is no exception. Within the last decade, subdivisions have sprung up all around the fringe areas of the city. Some of these subdivisions have been annexed by the city while others remain as independent communities. In either case they presented formidable problems in the routing of transmission lines and the procurement of suitable right-of-way.

The cost of obtaining easements or purchasing the property was far greater than the cost of the line in many cases. In addition to the ROW purchased it was necessary on some occasions to pay damages due to the alleged depreciation of adjoining properties.

To further complicate matters, it was necessary to construct new substations in older sections of the city and connect them to the 138 kv transmission system. It appeared at first that underground cable was the only solution. However, the high cost of such an installation induced the City Public Service Board to seek other means. This resulted in the development of a 24″ square steel tower utilizing short arms and post type or pin cap insulators with a special type hanger to prevent overhanging of property lines, and to maintain adequate clearances between the conductor and the tower.

The first experience with this type of construction occurred when building a 138 kv line from the Austin Road Substation to the Tenth Street Substation.

The Austin Road Substation is located in the extreme northeast section of San Antonio and the Tenth Street Substation is located in the heart of a commercial area only about one half mile from the downtown business area.

A preliminary survey determined that suitable right-of-way for an overhead line could be obtained from the Austin Road Substation to within 2.2 miles of the Tenth Street Substation. From that point on, no right-of-way could be obtained without buying a string of occupied city blocks.

It appeared at that time that it would be necessary to install an underground cable to extend the line on to Tenth Street Station but as stated previously the relatively high cost of this underground installation prompted an investigation of the possibilities of building a 138 kv overhead line along the city streets by developing a special type tower suitable for such an application.

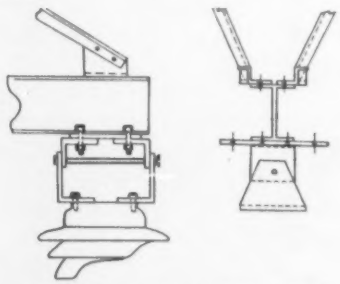
This decision was also influenced by the fact that a combination of underground and overhead construction was undesirable from the viewpoint of using carrier relaying.

Several types of structures were considered including one with all the conductors suspended from one side of the tower. However, the final design selected was a 24″ square tower with a triangular conductor configuration and varying in height from 70′ to 84′.

Part of the route selected for this line was along a street that adjoined and paralleled the railroad yards for more than a mile. Permission was granted by the railroad to overhang their property so that there was no problem in obtaining the necessary clearance between the tower body and the conductor as long arms and standard suspension insulators could be used for this portion of the line. However, at each end of this street the line passed through a residential and commercial area. In order to avoid overhanging the property lines in these areas, it was necessary to install the conductor within 4′-6″ of the sides of the tower.

The first thought was to use some kind of a light "stand-off" insulator mounted horizontally in conjunction with a string of suspension insulators but after consulting various manufacturers it was discovered that no suitable "stand-off" insulator was available.

The final solution was to use a 161 kv station post type insulator hanging from a special type swinging bracket mounted on the arm that would permit longitudinal movement but prevent transverse movement except for a small amount in the suspension clamp. A detail of this arrangement is illustrated.



After the basic design was decided upon the necessary drawings were submitted to a manufacturer for detailing, fabrication and full scale testing of a sample tower in order to "prove" the design.

The first towers were designed to support 3 - 556,500 ACSR conductors and one ⅜″ steel shield wire with a wind loading of 80 mph (actual velocity). Maximum span length was 350′ and the maximum tension on the conductors was 7500#.

The familiar laced column construction was used with the lacing welded in place. The tower was fabricated in sections, none to exceed 30′ in length, and these sections were joined or spliced together with rivet bolts.

solve problems

The base section was made to extend 10′ above the ground to facilitate setting and plumbing. This section was sheathed above the ground with ⅛″ steel plate to prevent unauthorized persons from climbing the tower. As an added precaution a fence guard was placed above the plate.

Arms were made of I beam sections and were designed to fail before the body of the tower was damaged in the event a broken conductor or similar occurrence caused design stresses to be exceeded.

Full scale tests were conducted by Anchor Metals Inc., the fabricator of the towers. The results of these tests are tabulated in the table below.

Two angle towers were required in the construction of this line. One for a 90° angle and the second for a 20° angle. The 90° tower was designed for a vertical conductor configuration and was guyed two ways.

The 20° angle had the same configuration as the tangent towers except the conductors were dead ended on the arms and the tower guyed against the resultant pull of the conductors and shield wire. Figure 1 shows the general arrangement of a tangent tower. Figure 2 shows a medium angle tower with guys, and Figure 3

Per cent design load	Deflection in inches at top arm
50	2.25
75	6.25
100	11.0
125	16.0
150	18.0
175	20.0
200	24.0
275	32.0

The temporary foundation failed at 275% design load. When the load was removed, the tower had a permanent deflection of 7.5 inches. The arms failed under a longitudinal load of 1200 lbs.

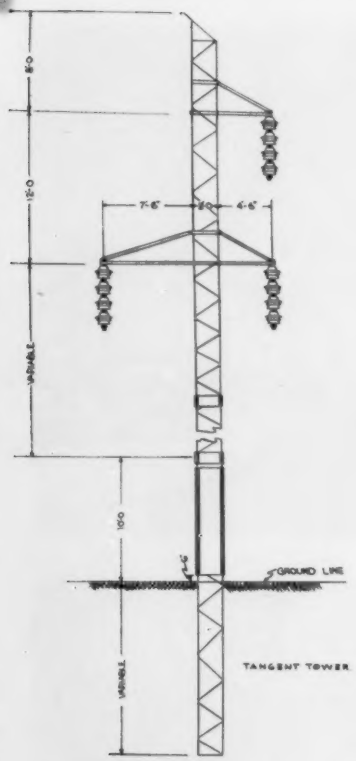


Fig. 1—Tangent tower

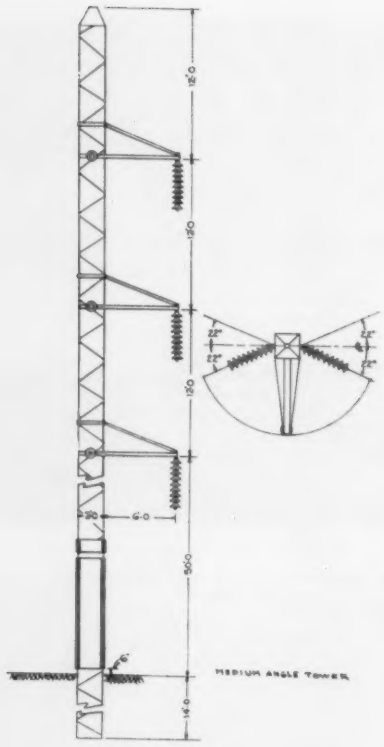


Fig. 2—Medium angle tower

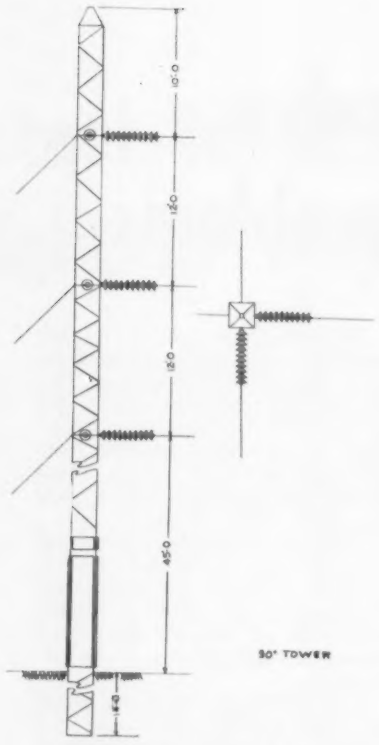


Fig. 3—90 degree tower

shows the 90° angle tower.

In order to provide adequate foundations a number of test holes were drilled and an analysis of the soil made. These tests resulted in the following foundation design. A 48″ diameter hole was dug ranging in depth from 11½ ft. to 15 ft. depending on the type of soil encountered.

The base section of the tower was placed in this hole and plumbed and aligned, the hole then filled with concrete to a point 6″ above ground level. Since the towers were located between the curb and the sidewalk, it was necessary to remove both in order to drill the foundation holes. After the tower base was installed the curb and sidewalk were replaced.

In one block the sidewalk extended to the curb line. In order to safeguard pedestrians, a small light with a porcelain reflector was mounted on the tower.

The assembly and erection crews followed the foundation crews after allowing sufficient time for the concrete foundations to "set."

The assembly crew bolted the tower sections together and attached the arms and insulators. The erection crews lifted the towers into position with a crane and joined them to the foundation section. Ten to twelve towers per 8 hour day were erected in this manner.

A six man crew was used in assembling the tower and two men plus the crane operator were used for erecting the towers.

This line was energized in February, 1956. There have been no non-scheduled outages to date.

A second line using this same type of narrow base towers was erected in 1957. This line extended from the Austin Road Substation to a new substation site in Terrell Hills, an independent incorporated community located within the city limits of San Antonio.

This was a double circuit line for part of the distance where suitable right-of-way was available. However, for a distance of 1.95 miles, it was necessary to build along roads or streets. After making a preliminary survey, the most feasible route appeared to be along a side street for about 0.25 miles, turn a 45° angle and build along each side of Highway 81 to the substation site. A 90° turn was necessary to enter the substation property. Route 81 is 120′ wide in this area and has a heavy distribution line on each side for most of the distance involved. In addition there are water, gas, telephone and sewer lines buried on each side of the highway, the exact location of these facilities being rather vague.

Due to the varying location of these underground facilities it became necessary to move several of the structures a short distance to either side of the planned location resulting in a line that was not exactly straight.

The majority of business places along the route were drive-ins, motels and gasoline stations with driveways occupying most of the frontage making the choice of structure location very limited. Since traffic is very heavy along this stretch of highway, the concrete foundations were extended 3′ above the ground to provide protection to the structure in the event it was struck by a vehicle.

We had anticipated considerable opposition to the construction of this line by the property owners; however, after explaining to several of them that the line was to feed a substation that would serve them with electricity, and that modern street lights would be

(Continued on page 134)

Bandage applies preservative to poles

◆ A DEVICE to cut the cost of ground-line preservative treatment of standing poles has been developed by Chapman Chemical Co., of Memphis. The Pol-Nu bandage-maker holds a 300-foot roll of poly-kraft paper and about 40 pounds of the grease-type preservative containing 10 per cent Pentachlorophenol. It can be carried to pole locations inaccessible to power vehicles. The paper backing insures the penetration of the preservative into the pole and prevents its being lost into the surrounding soil. The bandage treatment is expected to result in up to 10 or 12 years of additional service for each pole.

Fig. 1—As paper is pulled through device, preservative is spread over it, forming a bandage.

Fig. 2—Preservative flow is stopped, and bandage is raised to be cut to desired length.

Fig. 3—Bandage is wrapped around pole to provide preservative protection at groundline area.

Fig. 4—After the hole is back-filled, the bandage-maker may be easily carried to the next pole.

Automatic reclosing practices

By R. J. Cooper
Operating Manager
Georgia Power Company
Atlanta, Georgia

◆ INFLATION and automation have caused us to take another look at our automatic reclosing practices. There are strict demands for uninterrupted service unheard of until recent years by some of our customers, due to improved automatic type manufacturing processes.

If we expect to supply satisfactory service to these customers, every economical means for its improvement must be used. This includes fast tripping during faults to prevent excessive permanent damage and fast restoration or reclosing as soon as the fault is removed to shorten interruptions.

Our restorative schemes are just as important as our schemes for interrupting faults. We spend a great deal of time and money in our protective relaying schemes. We worry about coordination and selectivity and do an excellent job getting breakers opened—now what about getting them reclosed?

Almost everyone has gone beyond the point of just applying automatic reclosing to radial type circuits. We now put reclosers on multi-terminal interconnecting lines, transformer bank breakers and station busses or any place that can be used to tie the system back together, restore service, or save a busy operator's time.

Operators in the more important attended stations and plants now consider reclosing relays as a valuable necessity rather than the first step toward automation. With graphic or recording type operation indicators and automatic reclosing breakers, it is not hard to convince an operator that these devices are valuable aids and not just mysterious "black boxes" and "lie detectors."

Circuit breaker economy

As more and more inflation creeps up on us, those interested primarily in relay and control problems must come to realize how much harder it is becoming to justify economically the installation of circuit breakers. When you stop to think that each 230 kv circuit breaker installed with its associated disconnecting switches and protective relays represents an expenditure of about $150,000, each 115 kv breaker about $73,000, and each 46 kv breaker about $30,000, then we are indeed challenged to use every possible means to get full benefit from each installation. Proper reliable automatic reclosing schemes are necessary if maximum benefits are to be realized from this expensive equipment.

There is a temptation on some occasions where we have had a difficult problem in selectivity to solve and we finally get the operation straightened out, to delay reclosing for a few seconds in order that everything gets reset and settles down. If there are no customers involved, possibly such action is excusable but even then it is not getting maximum benefit out of a reclosing scheme. If customers are involved, we should never assume that a few seconds interruption doesn't make any difference in their operation.

Fast reclosing sought

Several years ago, we attempted to recognize the fact that we needed a very flexible type reclosing scheme which could be applied to line breakers on our transmission system, and our operating and engineering sections cooperated in developing and using such a scheme. We have attempted to get everything possible out of the fastest reliable reclosing scheme we could devise that was flexible enough to fit all our demands regardless of the type protective relay scheme used. In order to accomplish this, we have made some modifications in the application of the conventional equipment involved.

Our 115 kv transmission system is fast becoming a distribution system as we now have customer stations served directly from step-down transformers connected to the 115 kv lines. We also have many transformer stations to step down to sub-transmission voltage that do not have 115 kv line sectionalizing breakers and are just tapped stations. All of these loads tend to place more emphasis on the importance of restoring service as quickly as possible after transient faults.

In extreme cases it might give the relay engineer a little more latitude in applications and settings even to the extent of allowing overtripping if he is sure there is a fast reliable reclosing scheme to restore normal connections with no apparent loss of load.

Intermediate line sections between tapped stations have to be removed from service for maintenance or improvements at times. The relay engineer's desire to dictate the time of such operation is fast becoming a losing proposition in the face of "overtime pay" and not enough Sundays. When these operations have to be done during the peak period, then a flexible type reclosing scheme that is not controlled by variations in the protective scheme is even more desirable.

Reclosing relay timing intervals are all set for 0-15-60 seconds on 90 second relays. This interval is used as far as practical on a system-wide basis for all line breakers for transmission, sub-transmission and distribution. Main exceptions are caused by special customers' equipment and customer requests. Standardized timing intervals reduce the memory work on the system operator and interruption clerk. They are also of real assistance in analyses of serious system disturbances.

This standardized scheme provides the necessary features to check all three phases for line-side voltage at the instant of energizing the breaker trip coil for any reason. Thereby we know whether the line is dead by the time the local breaker opens or we know when the remote breaker or breakers open by the loss of line-side voltage. A provision is made to start checking synchronism also during the time of tripping. A choice is made available with a manually operated selector switch as to whether an attempt is to be made from this point to energize a

reviewed

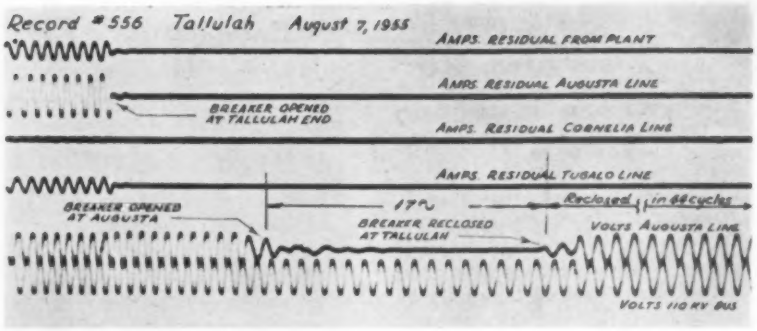
dead line, or whether this breaker is to wait for a hot line, check synchronism, and close.

Temporary changes in operation or permanent improvements at adjoining stations do not render such a scheme obsolete and require expensive reconnections. Operating procedures can take into account unusual system conditions and a change does not require the continuous attention of an operator but perhaps just a change in position of the selector switch which is mounted on the control panel.

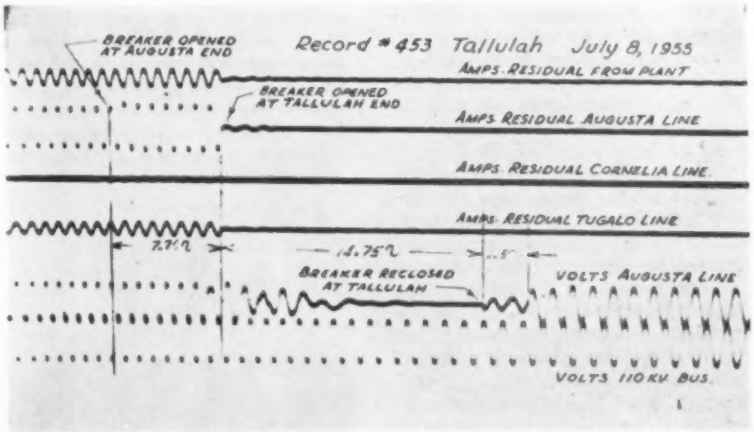
Line side checking device

In checking three-phase line-side potential a large percentage of users are overlooking an inexpensive method, the vital parts of which are already provided but not used. We advocate that every 115 kv breaker that is purchased to be used for a line breaker be equipped with one bushing type potential device to be used for checking synchronism manually and automatically and for operation of one phase of the voltage checking relays.

We buy two extra bushing potential device high voltage cables with fittings at a cost of about $125.00 each. These are used to connect the "hot" bushing taps on the other two line-side phases through the coils of two small telephone type relays to ground. The small relays are mounted in aluminum slip-cover boxes directly on the breaker tanks. A 2150 ohm relay with specially im-

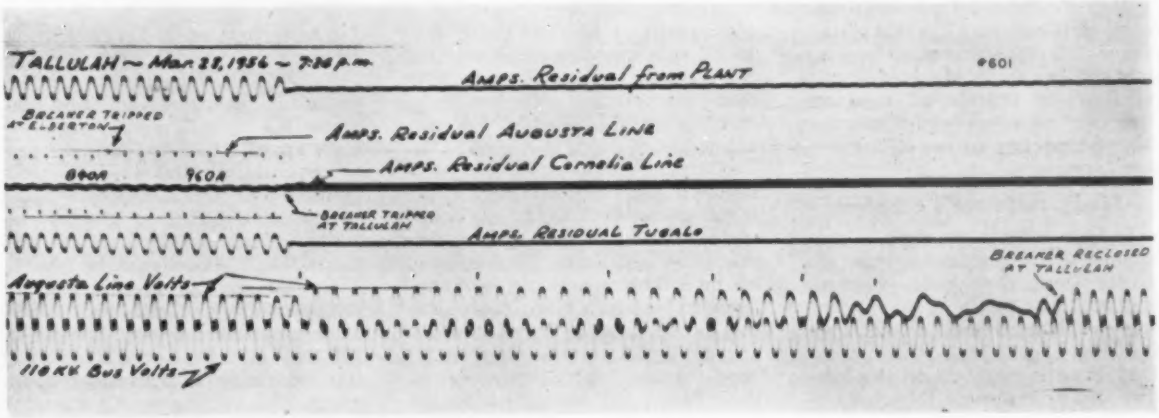

Record #556 Tallulah August 7, 1955
AMPS. RESIDUAL FROM PLANT
AMPS. RESIDUAL AUGUSTA LINE
BREAKER OPENED AT TALLULAH END
AMPS. RESIDUAL CORNELIA LINE
AMPS. RESIDUAL TUGALO LINE
BREAKER OPENED AT AUGUSTA
17 ~
Reclosed in 44 cycles
BREAKER RECLOSED AT TALLULAH
VOLTS AUGUSTA LINE
VOLTS 110 KV BUS

Record #556—This oscillograph record shows very clearly the advantage of line side voltage interlocks for instigating reclosing after a sequential tripping operation. In this instance customers served from the line were without power only 17 cycles, and the use of the line as a through transmission line was lost to the system for only 61 cycles.



Record #453—A situation very similar to that of #556 is shown here. The sequence of breaker operations was reversed but outage times were even shorter for both customers and transmission system.

Record #601—In this situation, breakers at Elberton and Tallulah opened in a sequence very similar to that of Record #453. After both breakers were open, the line side voltage increased about 35 per cent and gradually dropped down with decreasing frequency over a period of 30 cycles. At first opportunity for the voltage checking relays to drop out, a closing impulse was completed and the line successfully reclosed.



pregnated coil is used and the relay cost is about $9.00 each. If we stop to consider that the bushing potential device was required anyway, then we have provided a way to check all three line-side phases for potential at a total additional cost of about $500.00.

If bushing potential devices are not now being used, then three telephone type relays connected to the three bushing taps would serve the same purpose at a total cost of about $650.00 to supply an indication of three-phase line-side potential.

Interlocking scheme

Contacts on these small relays can be very effectively arranged to interlock the reclosing relay action and energize pilot lamps from battery or station service sources if desired. By arranging contacts in series you can be assured that reclosing is instigated at the instant the three phases are de-energized even though line terminals may be opened sequentially or simultaneously.

By careful pre-selection of the position of the dead line selector switches, we can close from both ends of a dead line simultaneously or close one end dead and have the other wait for a hot line and check synchronism. We can be assured we will not close in on a line that has an open phase, if it is hot.

These operations will be performed regardless of what or who caused a breaker to trip unless it was tripped from the control switch. If it was tripped from the control switch, all automatic reclosing is made inoperative.

Experience has demonstrated that the type scheme described will function to provide successful restoration on the first operation about ninety per cent of the time. With fairly high speed circuit breakers and three zone distance type protective relays, for faults within the reach of zone one from each terminal, total circuit outage time of from eighteen to twenty-two cycles can be obtained. Faults in the line outside of zone one from one terminal would add timing of zone two to the circuit outage time.

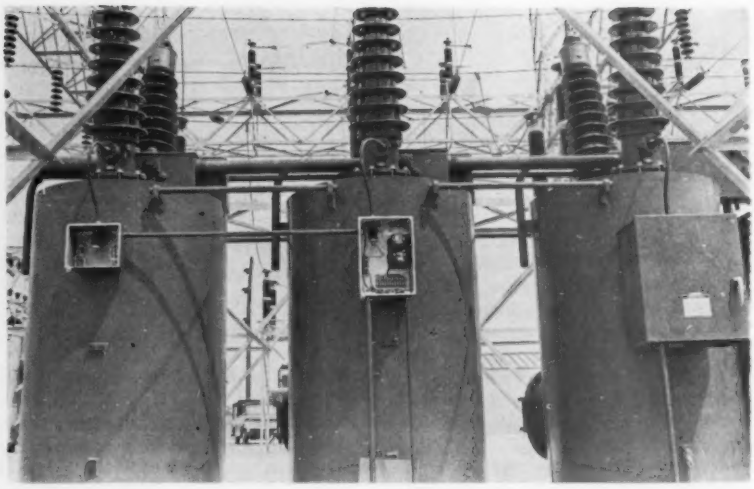
Study customer's problem

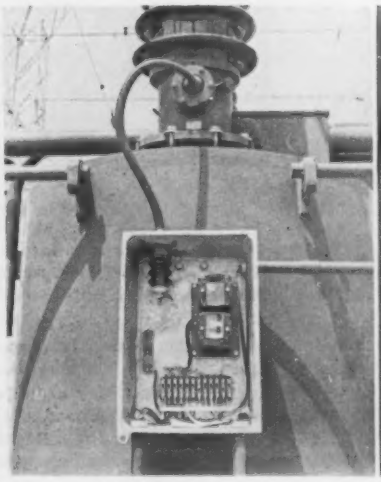
In our efforts to supply good service it is necessary that the utility engineer be versatile enough to understand the customer's problem as well as his own. On some occasions this means studying the problem on the location and determining the exact requirements of the service. If it is found that these requirements fall within practical limitations of the operation of the utility's equipment, then the solution becomes evident.

Sometimes one of the most severe types of problems is to attempt to secure fairly high speed reclosing on a circuit that serves a customer with some generation of his own. This generation will continue to feed into a line fault after the source breaker opens, thereby preventing successful reclosure. A good "selling" job is required on the customer to convince him that faster separation of his generating equipment means better service for him and, incidentally, all the other customers served from the same line.

In an effort to be sure we are accomplishing what was originally intended, it is almost necessary to use an automatic oscillograph to analyze several operations under actual field conditions.

One example is given by the accompanying oscillograms. They show what was accomplished on a 100 mile, 115 kv steel "H" frame, type line with no overhead ground wires. The oscillograms were tak-





This relatively inexpensive device for checking three-phase line side potential includes a standard potential device on the No. 1 bushing, a tap from No. 3 bushing, and a tap from No. 5 bushing connected to small telephone type relays in a box on the middle tank of circuit breaker. Below at left is a closeup of a bushing tap connected to small telephone type relay whose coil is protected by a spark gap. At right below is shown small auxiliary relays used to control various functions and conditions of automatic reclosing in conjunction with a standard type reclosing relay.

en at the Tallulah terminal of a two terminal 115 kv transmission line extending originally from Tallulah to Augusta that served two intermediate tapped substations.

The total load at these two tapped substations was about twenty-seven thousand kva. The principal load was of the usual textile mill type. Breakers at both terminals of this line were equipped with the type reclosing scheme previously described. The breaker at the Tallulah end was arranged to reclose instantly on a de-energized line. The breaker at the Augusta end reclosed after the line was re-energized.

Typical operations

Record #556 was taken on Sunday, August 7, 1955, during a light load period and shows very clearly the advantage of line-side voltage interlocks for instigating reclosing after a sequential tripping operation. The breaker at the Tallulah end of the line opened first, in about 8 cycles, then the breaker at Augusta opened about 10 cycles later. In this case, line-side voltage decayed very rapidly and the Tallulah breaker was back in 17 cycles. The Augusta breaker was set to wait for three phase line-side voltage and came in 44 cycles later. In simple language, service to the customers served from this line was out about 17 cycles and the use of the line as a through transmission line to the system was lost for 61 cycles.

Record #453, taken on Friday, July 8, 1955, on about the same situation as described above except a reversal in the sequence of breaker operations, shows an even shorter dead line time.

During early 1956, we installed two breakers in this same line at Elberton. This cut the line almost exactly half in two. It left one of the textile loads on the Tallulah-Elberton line and record #601 was taken on Wednesday, March 28, 1956. This is a very interesting record, in that it indicates that the breaker at Elberton tripped in about 8 cycles and the Tallulah breaker tripped about 10 cycles later, almost exactly as shown on record #453. After both breakers were open, the line voltage increased about 35 per cent and gradually dropped down with decreasing frequency also over a period of about 30 cycles. Then at the first opportunity for the voltage checking relays to drop out, a closing impulse was completed and the line successfully reclosed.

Regardless of what type protective relay scheme is used for fault clearing, the necessity of a check on the electrical conditions of the line is most important for successful reclosure.

Almost all of our transmission stations are fully automatic and operate under control of reclosing schemes as described. Even though there are operators on duty continuously at the steam plants and most of the hydro plants, we think service continuity is improved to have instantaneous one-shot reclosers on transmission line breakers even at these locations.

Unattended substations

Automatic unattended substations in remote locations always bring up the question of whether or not an attempt should be made to re-energize a dead station bus or transformer bank after an operation of differential type protective relays. Careful design of busses and improvements in modern transformers have eliminated a lot of these troubles, but we are still faced with the issue.

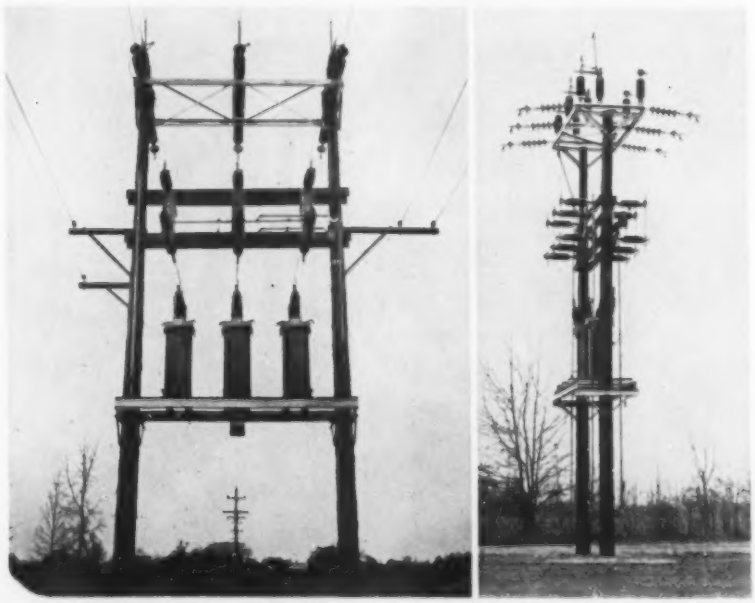
In an effort to provide as near continuous service as possible to our customers, it is our practice to attempt to re-energize a dead bus one time from a pre-selected source, provided this source is available at that time or from a second or third preferred source that is available, after a differential relay operation.

If the attempt to re-energize is successful and the bus remains hot for five seconds, all automatic devices are released and normal connections are restored automatically. If the attempt is unsuccessful, all further automatic reclosing is locked out. In any case, either operation causes a signal to be transmitted to some continuously attended point and someone is dispatched to the location to make an inspection as soon as possible.

Our fear of damaging expensive equipment more severely, due to automatic reclosing after differential relay operation, has entirely disappeared. We have had more attempts to re-energize a dead bus to be successful than to fail. On some occasions secondary cable or current transformer troubles have caused differential relay operations, and the interruptions have been short, due to automatic reclosing, rather than long and hard to explain.

Using the reclosing relay as a means to interlock low setting instantaneous trip devices in phase or ground relays is becoming more

(Continued on page 138)



FAULT CLEARING SIMPLIFIED—This neat compact arrangement utilized by a progressive electric utility company includes three pole-top air-break switches, three H-frame mounted R&IE 46 kv reclosers, and six disconnects in mid-pole position. Land purchase is avoided by mounting the reclosers on frame structures between poles.

Safe methods of working

By H. B. McMahan

Safety Director
Florida Power Corporation
St. Petersburg, Fla.

◆ PRIMARY DISTRIBUTION voltages back at the turn of the century were in the neighborhood of 2000 volts. I use the phrase "in the neighborhood of" because a range developed, and these voltages eventually ran on up to 2400 volts. The systems then were of course delta. It was at about this time that the matter of safe practices began to creep into the picture.

Would it surprise you to learn that the first piece of protective equipment the lineman had was his felt hat? He was quick to learn that if his hat was dry it would furnish enough insulation for him to do work on "hot" conductors and still not get a bad shock or burn. Of course, while he may not have realized it, he was depending somewhat on the skin resistance of his calloused hands. Is it any wonder in those days the idea got around that a lineman had to be tough and a sense of pride developed in these men in being able to handle the "stuff" hot?

We have long since learned that the business of handling "hot" conductors was then only in its "knee breeches." Lengths of garden hose used to cover "hot" wires soon disappeared and in their place came extruded shapes of rubber insulation. They answered a specific need and with them came also insulator hoods, blankets, and other protective devices. Some came on the market to stay —others, because of their impracticability, to disappear almost immediately.

With this protective equipment came something else of importance. This also grew out of necessity. It was a change from delta to wye connected circuits. The reason is, of course, an obvious one. Safe practices and safety equipment which had developed up to this point became insufficient, for disabling and fatal injuries now were on the up-turn. When "contacts" occurred on the wye circuits the vastly increased current flow took a heavy toll. These injuries were similar to the ones which had happened only once in awhile in the past when a ground inadvertently appeared on one of the old delta circuits and a lineman made contact. But, 2400/4160 volt wye connected distribution systems were here to stay.

Grounds half the circuit

Someone coined the phrase, "Grounds are one-half the circuit" and it quite aptly expressed the reason for the increased hazard involved on the wye systems. Creosoted poles more and more took the place of untreated poles. They were conductive at least to some degree. That still further aggravated the hazard.

The task of furnishing adequate protection for the lineman was now becoming a major one. Not only was it necessary to cover energized conductors, but now the covering of conductors and equipment at or near ground potential also became an absolute necessity. Not only was it necessary, but it was difficult too. Figure out for yourself, even today, some convenient and practical way for covering up a wrap-around guy. Or, try one for the end of a thimble eye bolt with its square washer and nut.

If your idea turns out to be a sound one, it will soon have a place in the protective industry market. The ideas forming the basis for many of the truly useful and practical items of protective equipment which are being manufactured and sold on the market

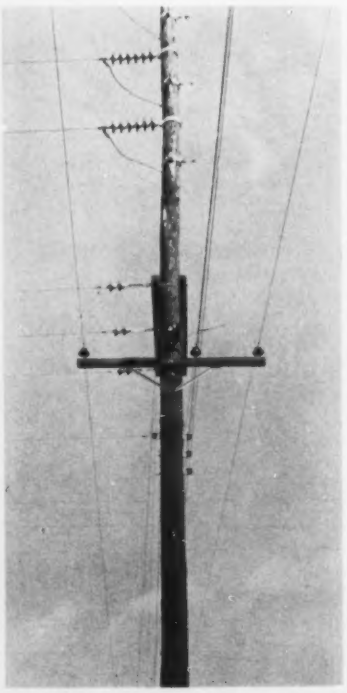


Fig. 1—Protection will provide climbing space in left-hand far or near quarter.

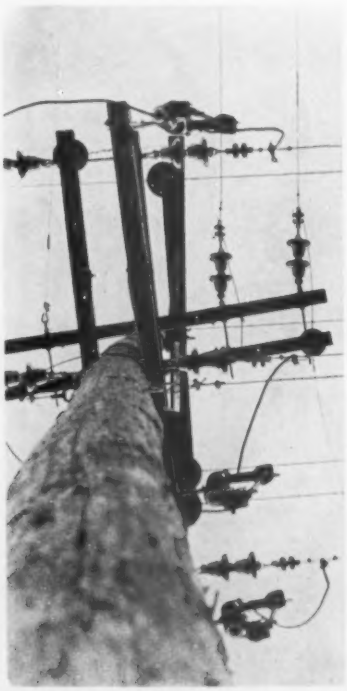


Fig. 2—Before work is started—impossible without proper covering.

This article was adapted from a paper presented before the recent Engineering and Operating Section Conference, Southeastern Electric Exchange, at Biloxi, Miss.

on energized 12 kv lines

today have originated from men in the field—who are constantly faced with difficult problems and who take the initiative in seeking to find reasonable answers for those problems.

You may wonder by now why I have dwelt so long before coming to the crux of this subject, "Work methods on 12 kv lines." It wasn't a new story at all, but there may have been engineers whose companies' distribution systems as of now had progressed to some intermediate point between the old 2200 volt delta distribution and today's modern 12 kv system.

If his system is today 2400 v. delta, 2400/4160 v. wye or 4800 v. delta, or 4800/8320 v. wye, and these all change with the load requirements, let me hasten to assure him that there are today both excellent protective devices on the market and excellent safe practices worked out for their use in all these ranges. His greatest problem as an operating man responsible for the enforcement of safe practices is the problem of bringing about a clear understanding of the necessity for the use of this equipment and these safe practices among the people with whom he works.

12 kv distribution system

Let's turn now to the 12 kv distribution system and its work methods. I know that the majority of utility men are familiar with hot line tool work. Certainly, in most of your companies it has gone on for years on transmission lines. The straight away jobs also on 12 kv are simple enough. However, as these jobs become increasingly complex in character—for example, work on dead ends, R.A.'s, buck arms, cutting in switches hot—those of us who have watched and studied this work have realized that the lineman was, by necessity, reducing his body clearances. Here was the start of a change in work method. What had truly been "hot stick" work in the past in which linemen had depended solely on distance from hot conductors for their protection now was beginning to modify itself.

This change first came to our own attention two years ago in the form of a request when a general foreman approached one of our safety men with the inquiry as to whether he would "go along" with the covering of energized 7,200 volt conductors with conventional line hose crossing over which he proposed to pull in a new three-phase circuit. It was agreed to do this, with the provision that the hose be installed on the circuit "cold" and "grounded," after which the covered circuit was re-energized and

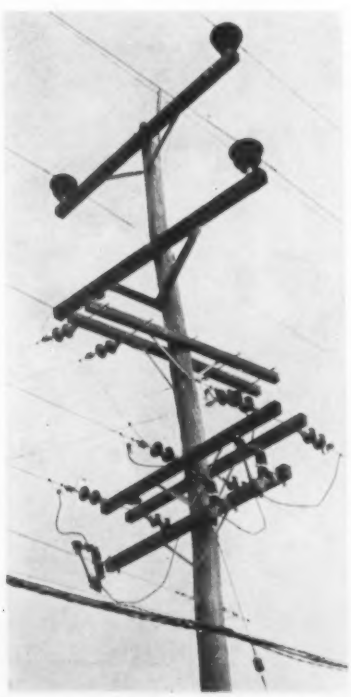


Fig. 3—Disconnecting switch jumpers can be removed at hot taps.

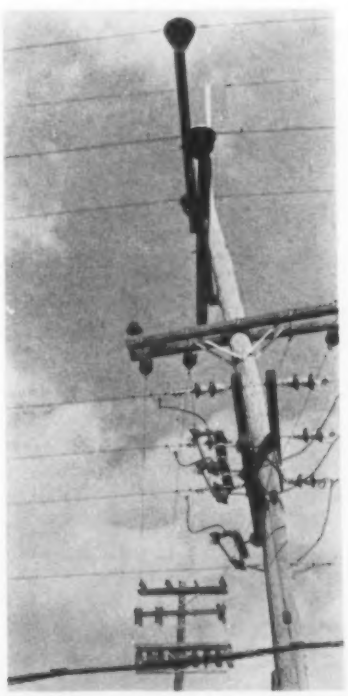


Fig. 4—Climbing space will be in left-hand near quarter after covering.

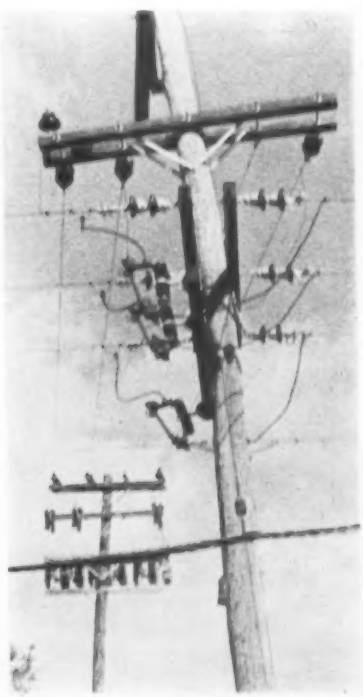


Fig. 5—Jumpers can be laid over the crossarm or carried on collar rope.

worked over. This was, of course, a laborious and time-consuming process, but the method worked and lessened the danger.

We felt certain that our line hose and hoods would stand up satisfactorily for work on the increased voltage. However, we were apprehensive about rubber blankets and rightly so for at the higher voltages they are cut rather readily by corona. These physical characteristics you can readily prove up on your own system, if you so desire. The idea worked successfully and other adaptations came along rapidly. For example, when "stirrups" froze up on lines, fiber covering often could not be used because of insufficient space and again conventional blankets, hose and hoods came into use not as a permanent solution, but as a stop-gap protective measure.

Corona resistant materials

After two years we have taken the bull by the horns. New highly corona resistant covering materials (some synthetics, others mixture of natural rubber and synthetics) came on the market in late 1957. There have been improvements over the years in rubber gloves and leather protectors. So, we now propose to test out this equipment in use and a part of this program has already been set in motion. These are the steps:

1. Explain to our own linemen (through the cooperation of our division engineers and foremen) the need for more adequate tools and work methods on 12 kv.

2. Offer to them the possibility of doing work first in proximity to, *not on* (note that statement carefully) 12 kv using the new corona resistant covering materials.

3. Give them the opportunity of recommending their choice of a glove type most suitable for this work.

4. Review the whole problem generally with our union safety committees and business agent. We propose to keep them informed of progress with this project from start to finish.

5. Select a number of crews, both rural and urban, and supply them with the new covering materials and with both 15,000 and 20,000 volt gloves from which to choose in doing this work. The 20,000 volt gloves have a contoured red roll, are laminated, red on the inside, black on the out, and are thus positively identified. The first phase of this project will cover a period of six months in which the equipment will be used only for work in *proximity* to and *not* for work *on* energized 7200 volt conductors. Should this step prove to be a successful one, we then propose to move on into the final stages of the program.

6. The crews selected for this test, using five foot insulating platforms, will then begin to do work *on* properly covered 7200 volt conductors, using rubber gloves of the voltage rating which they have chosen.

Modifying work practices

At the present time we are already well under way with this program. Do not misunderstand, we have no intention of discarding our hot line tools and work methods. But rather, as you can see from our description up to this point, this is a modification of work practices combining ideas and equipment from both of the older methods.

It is our belief that the proposed method is sound. Care must be exercised to prevent ground contacts at all time, but this is no different from the precaution which we must continually exercise on all wye systems. We feel that there are certain safety features connected with the proposal which may prove advantageous over some of the older methods,

(Continued on page 132)

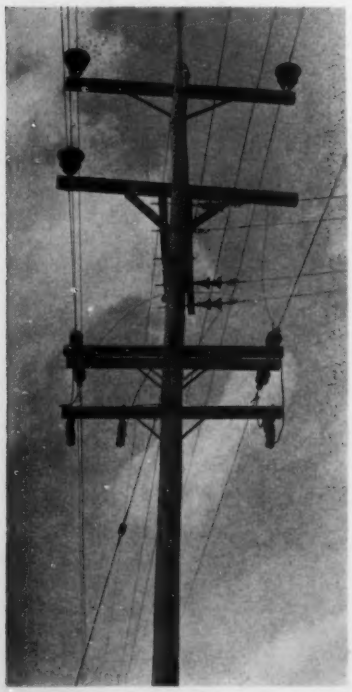


Fig. 6—Climbing space is on the back side of the lateral tap.

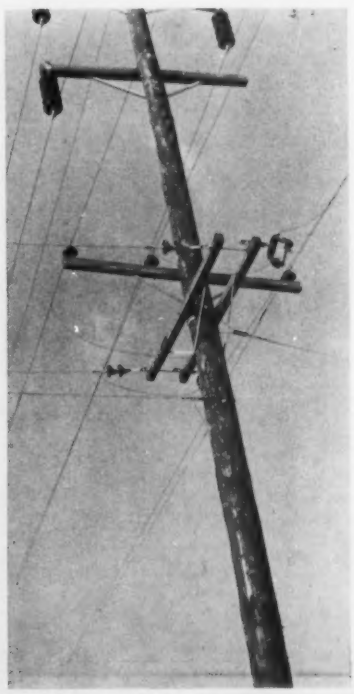


Fig. 7—Climbing space is at the right-hand near corner.

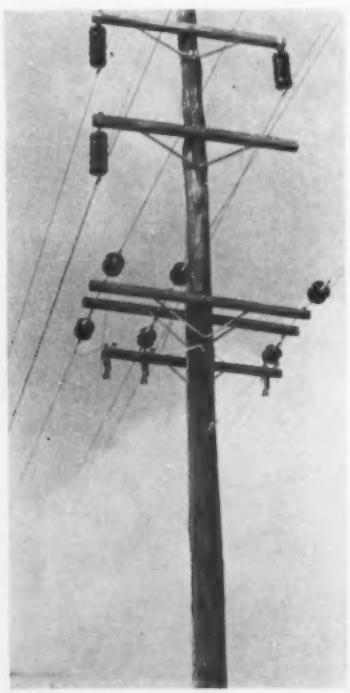


Fig. 8—Disconnect to be jumpered for clearance, or else covered.

the price is RIGHT!

TYPE M STRAND

If someone asked you the price of Copperweld Strand, the chances are that you'd err on the high side. Why?

Simply because this permanently non-rusting guy and messenger strand has for more than 40 years been rated absolute tops in its field. Judged by the admittedly longer service and maintenance-free life its use assures, you'd naturally expect it to cost more—much more. But that's no longer true.

Now, with the new Type M Strand, you can obtain all the money-saving and performance advantages of Copperweld construction at a price comparable to that of ordinary strand. This was made possible by developing new higher strengths especially suited for guy and messenger use, and introducing new cost-cutting production techniques.

Pliable and easy to handle, this superior strand is available in a complete range of breaking strengths. Ask us to quote on your guy and messenger requirements. You'll find the price is right.

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Furnished in coils of 250, 500 and 1,000 feet depending on the size. Reels of 2,500, 5,000 and 10,000 feet are also available.

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TYPE M™

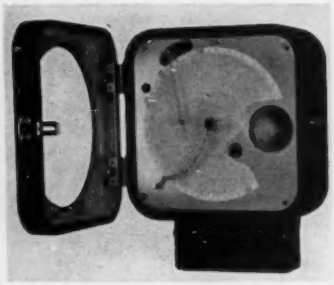
GUY and MESSENGER STRAND

Notes on new utility equipment

Graphic meters feature carryover drive mechanism

A NEW LINE of Lincoln Graphic Meters with charts driven by a synchronous-carryover drive mechanism has been introduced by Sangamo Electric Company, Springfield, Ill. The addition of the carryover feature keeps the graphic meters on time during practically all power interruptions for as long as 14 hours. The meters also provide a record of the number and time of outages.

Supplying the carryover power for the chart drive mechanism is a



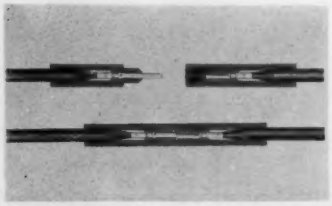
clock-type mainspring and escapement. After power outages the synchronous motor automatically rewinds the mainspring. A friction clutch between the motor and mainspring prevents stalling when the spring is fully wound.

The synchronous-carryover gear train is interchangeable with the synchronous gear train of all types of Lincoln Graphic Meters now in service.

For additional data, ask for item U-1001, using the coupon on page 139.

Underground cable connector packaged in four-part kit

A NEW WATERPROOF, underground cable connector—packaged in a four-part kit for easy field installation in minutes—has been announced by the A'G'A Division of Elastic Stop Nut Corporation of America, 1027 Newark Ave., Elizabeth 3, New Jersey. The



new cable connector kit provides a reliable, easily applied, and economical underground connection.

Once assembled, the field-installed connector may be separated for testing or servicing the line, and the circuit re-established with the same easy plug-in method of the A'G'A factory molded-on connector which has been supplied with precut lengths of cable.

The A'G'A field-assembled connector kit was developed to meet the varied requirements of street, highway, tunnel, and airport lighting equipment and to be used in power distribution where the use of bulk cable is advantageous.

The kit is composed of a molded rubber receptacle housing with a disposable assembly sleeve, a metal receptacle fitting with a disposable assembly pin, a molded rubber housing for the plug, and a metal plug fitting. Insulating jelly is inserted into each housing at the factory to fill all voids. This prevents the formation of corona, excludes moisture, and eases the attaching to the cable.

For additional data, ask for item U-1002, using the coupon on page 139.

Wireholder designed for service entrance masts

EXCLUSIVE NEW design features and sound engineering principles of parts and assembly are outstanding qualities of a completely new pipe mounting fireholder offered by Porcelain Products, Inc., Carey, Ohio. The new

"universal" wireholder, designed specifically for service entrance masts, will fit all pipe sizes from 1¼" to 2½".

Among the exclusive features of Porcelain Products' No. 652001 wireholder is the large copper-bail reinforced insulator with extra large wire hole, that meets and exceeds EEI wireholder specifications. Mounting bolts swedged rigidly to the bracket for ease of handling and installation is another Porcelain Products exclusive. A side-slotted, swivel-back bar permits installation on any service mast without removing nuts or washers.

All steel parts are heavy gauge for maximum strength and are hot-dip galvanized before assembly for excellent corrosion resistance and longer service life. The back bar is shaped in such a way that reversing is unnecessary for smaller pipe sizes, yet a sturdy tight fit for all size masts is provided. The new wireholder is neat and trim in appearance and is a compact, all inclusive, one-item pipe mounting wireholder to simplify stock and reduce inventory.

For additional data, ask for item U-1003, using the coupon on page 139.

Remote control system for unattended power stations

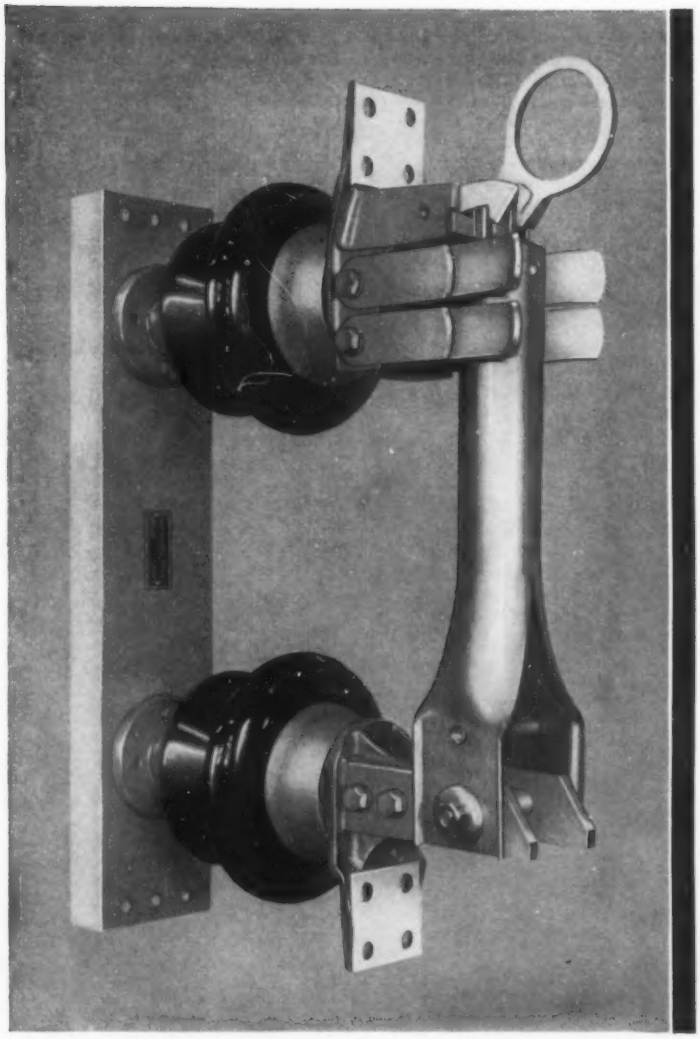
A NEW SYSTEM designed to provide more economical, centralized control of unattended electric power stations has been developed by the Applied Science Corporation of Princeton (ASCOP), P. O. Box 44, Princeton, N. J.

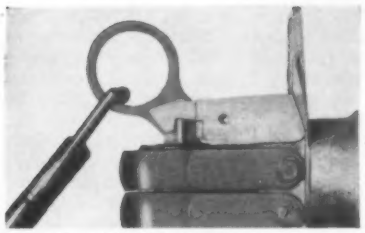
The new system provides up to 105 channels of control supervision, plus a maximum of 30 channels of continuous telemetry, over one transmission circuit.

The ASCOP system can use any transmission circuit capable of passing 15 pulses per second. Therefore it qualifies for transmission mediums from the lowest rental rate telegraph circuit to higher priced voice grade circuits and modern microwave radio links.

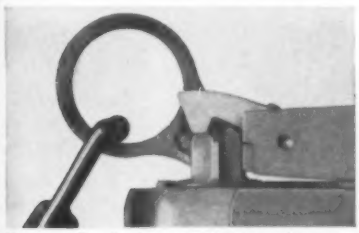
Coding and decoding circuits of dependable telephone-type relays form

the heart of the ASCOP system. Transmissions to both the central master stations and remote stations are accomplished by 14-bit signals.

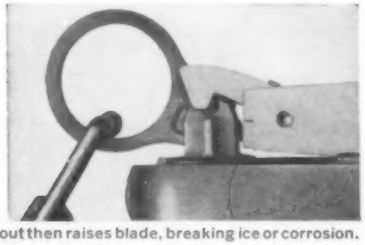




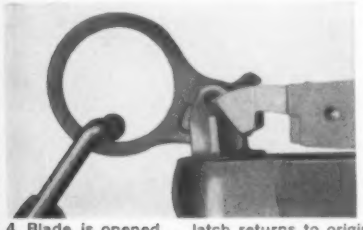
1. Operator inserts switch hook into 3-inch ring . . .



2. . . . and pulls down, raising latch fingers.



3. Blade pryout then raises blade, breaking ice or corrosion.



4. Blade is opened . . . latch returns to original position, ready for re-entry of blade.

RUGGED, POSITIVE-ACTING OUTDOOR DISCONNECT . . . the DELTA-STAR hook-operated B-2K switch

Here is a reliable heavy-duty hook-operated switch which offers the maximum in efficiency and ease of operation. Extreme rigidity of the tubular blade and formed hinge prevents contact misalignment even when the operator must stand to one side to open or close the switch.

A strong blade pryout makes operation positive even under heavy ice and corrosive conditions. The spring-loaded blade latch prevents opening under short circuit. Large hook ring eliminates difficulty of inserting hook.

High-pressure contacts of rugged construction plus ample material for heat dissipation assure efficiency.

B-2K switches are available in ampere ratings of 400, 600, and 1200, and voltage ratings from 7.5 to 161kv.

FREE CATALOG. This new illustrated brochure gives full technical information on Delta-Star B-2K Disconnect Switches. For your copy, send to Dept. 357, Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Ill. District offices in principal cities.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

These signals permit automatic triple code checks, insuring integrity of transmissions and preventing wrong operation or loss of data. Less than two seconds are required for the completion of any transmission.

The ASCOP system of pulse width telemetry permits continuous data gathering over the same single circuit used for supervisory control transmissions. When telemetering transmissions are briefly interrupted for supervisory control actions, continuous data output to display or logging devices is accomplished by simple memory units. A servo system automatically compensates for any distortions introduced between transducers and data outputs.

For additional data, ask for item U-1004, using the coupon on page 139.

Clamp features saddle with captured U-bolts

DESIGNED FOR primary and secondary deadending, the CUW-R type clamp introduced by Burndy Corp., Norwalk, Conn., combines the snub

action of a deep cable groove pocket with the wedge action of a V-groove for maximum holding strength on each cable size throughout the entire range. Four clamps cover range from #4 ACSR through 636 ACSR and #2 through 715.5 all aluminum.

Additional features include a saddle with captured U-bolts that prevent incorrect assembly of saddle, lifting eye, and side pulling eye standard on all sizes. Compact design facilitates covering with line hoses. Humpback cotter pin and headed clevis pin make for easier "hot" line work. Long U-bolts enable cable to be threaded into clamp without removing clamp, and belled cable entrance minimizes cable chafing.

For additional data, ask for item U-1005, using the coupon on page 139.

Neutral compression sleeves have high holding power

ANDERSON ELECTRIC Corporation, 700 N. 44th Street, Birmingham 1, Ala., announces the release of Anderson's new line of DCN Neutral Compression Splices. This line is

available in both the ½" and the ⅝" O. D. sleeves and is recommended for splicing short span ACSR and all-aluminum messenger neutrals, as well as service entrance triplex cable.

The sleeves are designed for use with combinations of #6 stranded to #1/0 stranded cable. Holding power of these sleeves is rated in excess of 50% of ACSR rated ultimate and 80% stranded aluminum rated ultimate. Correct insertion depth of cable and proper distribution of inhibitor is assured by a solid center stop. Both sleeve grooves are filled with Anderson inhibitor and capped with easily punctured plastic caps.

For additional data, ask for item U-1006, using the coupon on page 139.

Control panels are unique feature of oil reclaimer

A NEW LARGE mobile Hilco Oil Reclaimer was recently completed by the Hilliard Corporation, 100 W. Fourth St., Elmira, New York. The Model 500-X Duplex, Hilco Hyflow Oil Reclaimer is designed for purification of transformer insulating oils in the field to prevent oil or transformer breakdown. The Hilco Reclaimer removes water, sludge, acids and other oil oxidation products, dissolved paint, bushing compound, metallic soap, and other contaminants.

The unit consists of a flat bed trailer upon which is installed a 500 gph reclaimer, 375 and 275 gallon dirty and clean oil storage tanks, 50 kw

gasoline engine-driven, electric generating plant, hose reels, and storage space for filter material.

Unique features are the central electric and valve control panels operating oil and vacuum pumps and providing ready reading of all pressures, temperatures, fluid levels, and direction of flow. (Two single cartridge, fullers earth filters are handled by telescoping electric hoist.)

For additional data, ask for item U-1007, using the coupon on page 139.

Switch has epoxy resin to prevent shrinkage cracks

THE A. B. CHANCE Company, 210 N. Allen St., Centralia, Mo., is making a new porcelain housed disconnecting switch that uses epoxy resin to give a positive bond between metal parts and the high-grade, wet-process porcelain housing. The epoxy resin is not subject to shrinkage cracks that would permit water to enter and cause freezing damage. The switch is available in ratings of 200, 400 and 600 amperes at 7.8 kv.

The double-blade is heavy bus-bar copper, and the multiple contact points which give cool operation, are silver-button inserts. A pry-out lever

assists in opening the switch, and assures operation under all conditions.

The heavy, swivel-type bracket furnished permits the switch to be mounted in a vertical position or at an angle of 20 degrees to vertical. When the blade of the switch is down in full open position, it is completely dead since the hinge is electrically isolated. The door of the switch can be closed when the blade is in the open position to prevent weather damage to the contacts.

Terminals are cadmium plated for use with copper, ACSR, or aluminum conductors.

For additional data, ask for item U-1008, using the coupon on page 139.

New low-R ohmmeter checks circuit breaker contacts

A NEW MODEL low resistance test set has been announced by the J. W. Dice Company, Englewood, N. J. Resistance values as low as 1 microhm

can be measured within 2 per cent accuracy.

This portable test set consists of a model 151-S Microhm Meter plus a transistor type model SM rectifier for supplying both a 10 amp d-c and a 100 amp d-c current source. In ad-

NEW

JOINS 26% FASTER

Because there are no separate couplings to assemble on the job, Orangeburg's new CA Conduit lays faster—costs less to install. In addition, there are no coupling cartons to handle, transport or store.

Orangeburg's new CA Conduit comes, at *no extra cost*, with a factory-attached coupling at one end and a standard 2° male taper at the other end. To join—CA's long, lightweight lengths are placed end to end—hammered home in a simple, one-step operation. Actual installations *prove* Orangeburg's new CA Conduit joins up to 26% faster!

What's more, because the attached coupling is *flush* with the outside diameter of the conduit, new CA Conduit is easy to handle and store in neat, even stacks. And with the new flush coupling there's no need to "stagger" conduit joints in the trench. That means less cutting and tooling time.

New CA Conduit—like the millions of feet of Orangeburg Fibre Conduit in use since 1893—has self-sealing joints and impermeable walls that make it absolutely watertight. Its smooth 100% fibre raceway adds years to cable life.

Specify new CA Conduit on your next job. This addition to Orangeburg's line is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg's Standard and Nocrete Conduit with separate sleeve couplings are available as always. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y. and Newark, Calif.

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

dition, the Microhm Meter has its own self-contained 10 amp battery power supply which permits using the instrument in locations where power lines are not available or are de-energized.

The test set checks the condition of oil and air circuit breaker contacts and current paths from the bushing terminals without disassembling, thus saving many manhours of labor. It can also detect abnormally high resistance in cable joints, bus bar connections and current paths in other power equipment where the normal resistance is in the microhm range.

For additional data, ask for item U-1009, using the coupon on page 139.

Tangent supports have new extra heavy coating

THE PREFORMED tangent supports from Preformed Line Products Co., 5349 St. Clair Ave., Cleveland 3, Ohio, now have an extra heavy coating of neoprene to cushion their grip. They are the natural companion fittings with the Preformed "C" rural dead-ends.

Both Preformed tangent supports and dead-ends are made of stainless

steel for corrosion and abrasion resistance and neoprene-coated for a protective cushioning. This combination gives a low, uniformly distributed radial pressure over their entire holding area without injurious concentrated pressures.

These new fittings are available for 2 - No. 14, 2 - No. 12 copperweld "C" rural conductors (one-pair distribution wire) and 2 No. .083 galvanized steel.

For additional data, ask for item U-1010, using the coupon on page 139.

Distribution arresters are sensitive and consistent

THE NEW distribution lighting arrester, the O-B Thorex Dynagap Type DV-T from the Ohio Brass Co., 380 N. Main St., Mansfield, Ohio, is now available as a factory-installed component of distribution transformers. This saves the time and trouble of separate arrester installation, plus the cost of incidental connecting material.

Because these arresters contain vital internal elements that are interchangeable with Intermediate and Station Classes, they offer many protective and durability characteristics formerly associated only with heavier-duty models. In spite of this stepped-up design, O-B Thorex dis-

tribution arresters are from 10% to 50% smaller than comparable products.

Protective performance of the Dynagap is not influenced by heavy or light fault currents. The arrester is sensitive and consistent under all conditions of operation. Because of this, it may be located adjacent to, or remote from heavy power sources, or may be moved to any part of a system without jeopardizing its excellent protective characteristics.

For additional data, ask for item U-1011, using the coupon on page 139.

Transformer test equipment provides tests at any load

KNOPP INC., 1307 66th St., Oakland 8, Calif., announces the Uniload current transformer testing equipment, type AL-1, which simplifies testing. It contains a heavy-duty current-loading transformer, a high-accuracy Knopp precision multirange

current transformer standard, a variable-transformer current control, switches, over-load protection, etc., all housed in an attractive, compact console cabinet. It is carefully designed, precision engineered, and thoroughly tested to meet today's high-accuracy laboratory needs.

This equipment has all of the necessary current ranges from 10 to 2000 amperes inclusive, and it may be used to perform tests, in conjunction with the Knopp transformer comparator. The Type AL-1 provides tests at any load from light load to 200% load on current transformers that match the current ranges of the equipment. The current ranges are 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 150, 200, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 1800, and 2000 amperes.

For additional data, ask for item U-1012, using the coupon on page 139.

Hydraulic derricks can be moved under load

MCCABE-POWERS BODY Company, 5900 N. Broadway St., St. Louis 15, Mo., has announced the addition of two new "Pole-Master" hydraulic derricks to its line of Powers-American utility bodies and equipment.

The Series PM-1 "Pole-Master," which is completely new in design

and operation, has just been put into production. It can be furnished for installation at rear of body or at front of chassis, with hole digger if desired. All derrick movement is actuated by a single hydraulic cylinder, through a unique system of linkage which permits the positioning of the head sheave at any point in an operating arc of nearly 200 degrees.

The derrick is available in three sizes: Series PM-1-40 for handling poles up to 40 ft. in length; Series PM-1-55 for 55 ft. poles; PM-1-70 for 70 ft. poles.

Also new in the line is the Series PME-2 "Pole-Master" which combines the advantages of an extendable head sheave with the outstanding operating features of the company's widely used Series PM-2 hydraulic derrick.

Series PM-1 and PME-2 derricks can be moved under load, and require only a single-drum winch.

For additional data, ask for item U-1013, using the coupon on page 139.

INTERLOCKED ARMORED CABLE

For Power Distribution in New Plants or in Modernizing Old Plants For more current capacity than cable in conduit or other armored cable, *specify and buy Rockbestos A.V.C.* . . . for easy installation on racks or hangers beneath the ceiling or next to walls, *specify and buy Rockbestos A.V.C.* . . . . . To eliminate costly conduits and ducts . . . to save important dollars on materials and installation time, to permit quick, easy repairs, *specify and buy Rockbestos A.V.C.* . . . All interlocked armored cables are not alike . . . and, for maximum dollar-savings and maximum performance be sure to *specify and buy Rockbestos A.V.C.* Interlocked Armored Cable — the superior AVA Cable.

Write now for the new Rockbestos manual which gives the application and design data to help you *specify and buy Rockbestos A.V.C.*

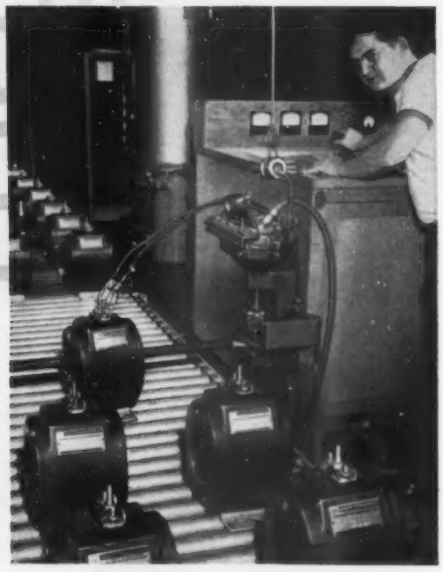
ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • OAKLAND • PITTSBURGH
ST. LOUIS • LOS ANGELES • SEATTLE • ATLANTA • DALLAS

ROCKBESTOS A.V.C.

THE SUPERIOR A.V.A. CABLE

ALLIS-CHALMERS



Now Available . . .

18 types of cast epoxy resin instrument transformers

To meet industry's growing demand for these superior quality instrument transformers, Allis-Chalmers has instituted a program of developing a number of new types for various applications — and has more than doubled previous production capacity.

No Maintenance — Easily Installed

Epoxy resin, virtually a miracle material, gives transformers complete protection—both electrical and mechanical—either outdoors or indoors.

Allis-Chalmers epoxy resin transformers:

1. Have excellent dielectric properties.
2. Can withstand wide temperature variations and severe mechanical shocks.
3. Are maintenance free . . . require no painting, resist solvents.
4. Can be installed in any position — quickly, easily.

Your A-C man will give you the complete story, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Types of epoxy resin cast transformers available

Type	INDOOR	OUTDOOR	INSULATION CLASS	CURRENT RATINGS (AMPERES) 10-5	15-5	25-5	40-5	50-5	75-5	100-5	150-5	200-5	300-5	400-5	600-5	800-5	1000-5	1200-5	1500-5	2000-5	3000-5	4000-5
BKM	X	X	600														X	X	X	X	X	X
LM	X		600													X						
MM	X	X	600										X		X							
TWM	X	X	600										X		X	X	X					
BK1M	X		5000															X	X	X	X	X
BKAW1M	X	X	5000															X	X	X	X	X
BKWD1M	X	X	5000															X	X	X	X	X
BKM PLUS 015	X	X	5000															X	X	X	X	X
LRM 45-KV IMPULSE	X		5000	X	X	X	X	X	X	X	X	X	X	X	X	X						
LDM 45-KV IMPULSE	X		5000	X	X	X	X	X	X	X	X	X	X	X	X	X						
TWM PLUS 015	X	X	5000										X		X	X	X					
BK2M	X		8700															X	X	X	X	X
BKAW2M	X	X	8700															X	X	X	X	X
BKWD2M	X	X	8700															X	X	X	X	X
BK3M	X		15000															X	X	X	X	X
BKAW3M	X	X	15000															X	X	X	X	X
BKWD3M	X	X	15000															X	X	X	X	X
K3M	X		15000	X	X	X	X	X	X	X	X	X	X	X	X	X						

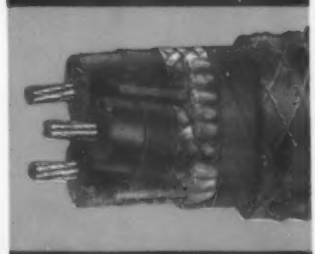
A-5814

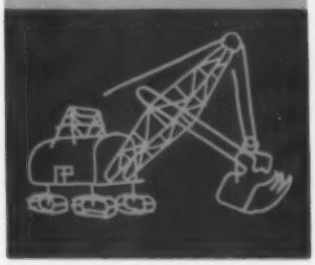
ALLIS-CHALMERS

the more reason for using TIREX®

TIREX cords and cables give longest service when not subjected to severe abuse. But when required, TIREX can take it. In snow and mud, under water and under pressure, TIREX cords and cables remain flexible, smooth, light and easy to handle, thanks to their original cured-in-lead construction. They won't snag or tear, and their fortified and tempered neoprene armor gives balanced resistance to abrasion, water, acids, oils, sunlight and flame.

Millions of feet of TIREX are on the job everywhere—transmitting power for mobile mining equipment, construction machinery and portable tools.





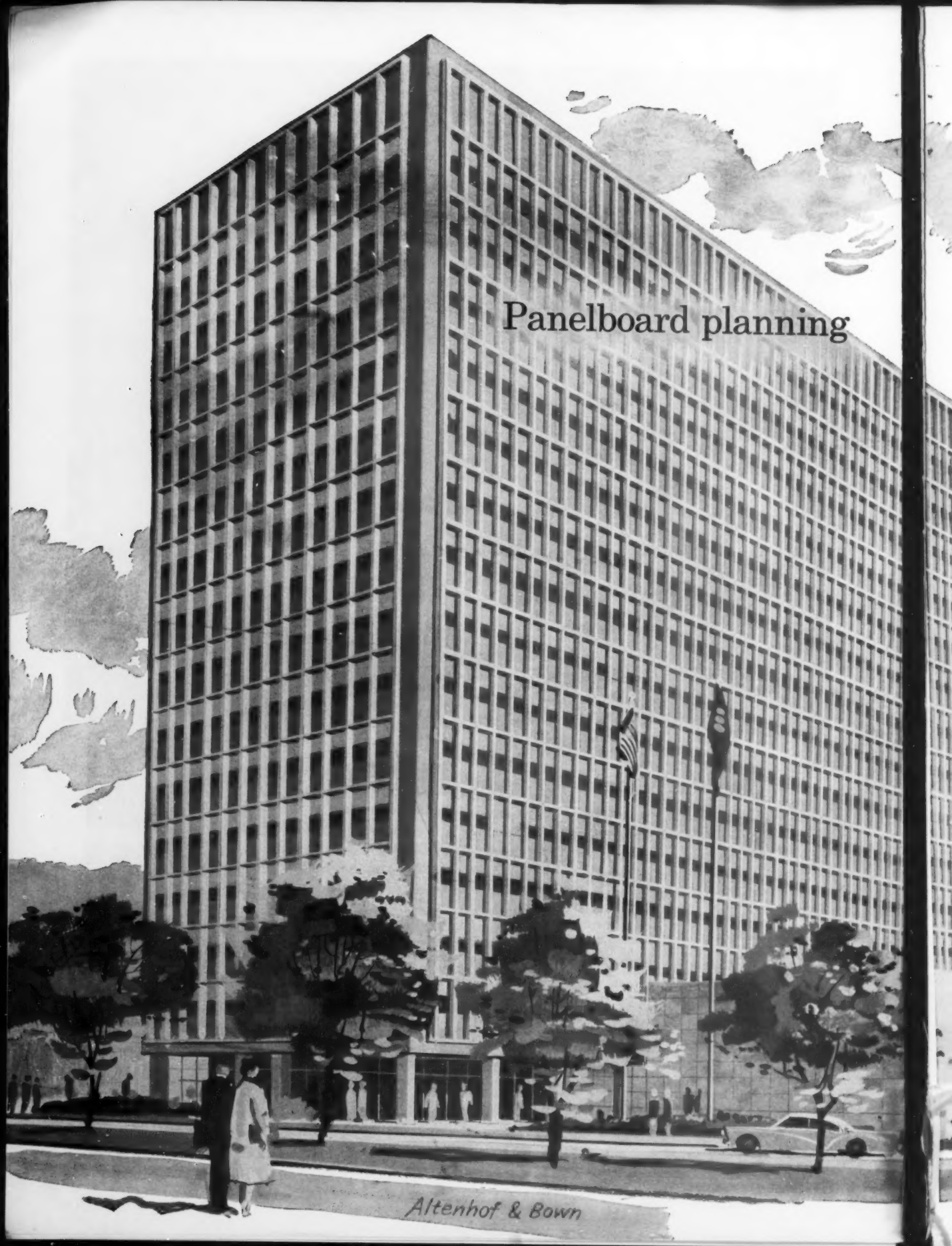
Simplex

LIVE BETTER ELECTRICALLY

WIRE & CABLE
COMPANY
79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"Visit booth 162, 4th National Electrical Exposition, Dallas, Nov. 18-20"

Panelboard planning



helps Power-Up State Office Building

The new Commonwealth of Pennsylvania Office Building in Pittsburgh exemplifies the type of planning that powers-up today for future needs.

More than 40 Westinghouse Panelboards (Type NLAB & Type CDP) provide for lighting and distribution system protection and service continuity completely adequate for today's demands, and readily capable of expansion or modification to meet tomorrow's ever-increasing electrical needs.

OWNER—General State Authority, Commonwealth of Pennsylvania
ARCHITECT—Altenhof and Bown
CONSULTING ENGINEER—Carl J. Long
ELECTRICAL CONTRACTOR—E. C. Ernst, Inc.
WESTINGHOUSE DISTRIBUTOR—Keps Electric Company

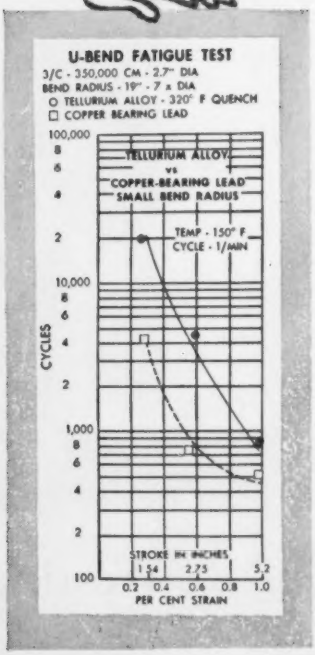
J-93542

Westinghouse CDP Panelboards installed in the new State Office Building to provide protection and control of power circuits. Shown on wall at left is one of the Type NLAB Panelboards which protect building lighting circuits.

YOU CAN BE SURE...IF IT'S Westinghouse

Any way you look at BENDING LIFE...

ROEBLING'S TELLURIUM LEAD ALLOY SHEATH LASTS 4½ TIMES AS LONG!



It's been proved in laboratory tests—the Tellurium Lead Alloy Sheath on Roebling Paper Power Cable has *4½ times more bending life* than copper bearing lead sheath! What's more, tests (and experience) prove this sheath has outstanding stability under heat... unusual resistance to age hardening... negligible creep rate at 200 psi, 150°F

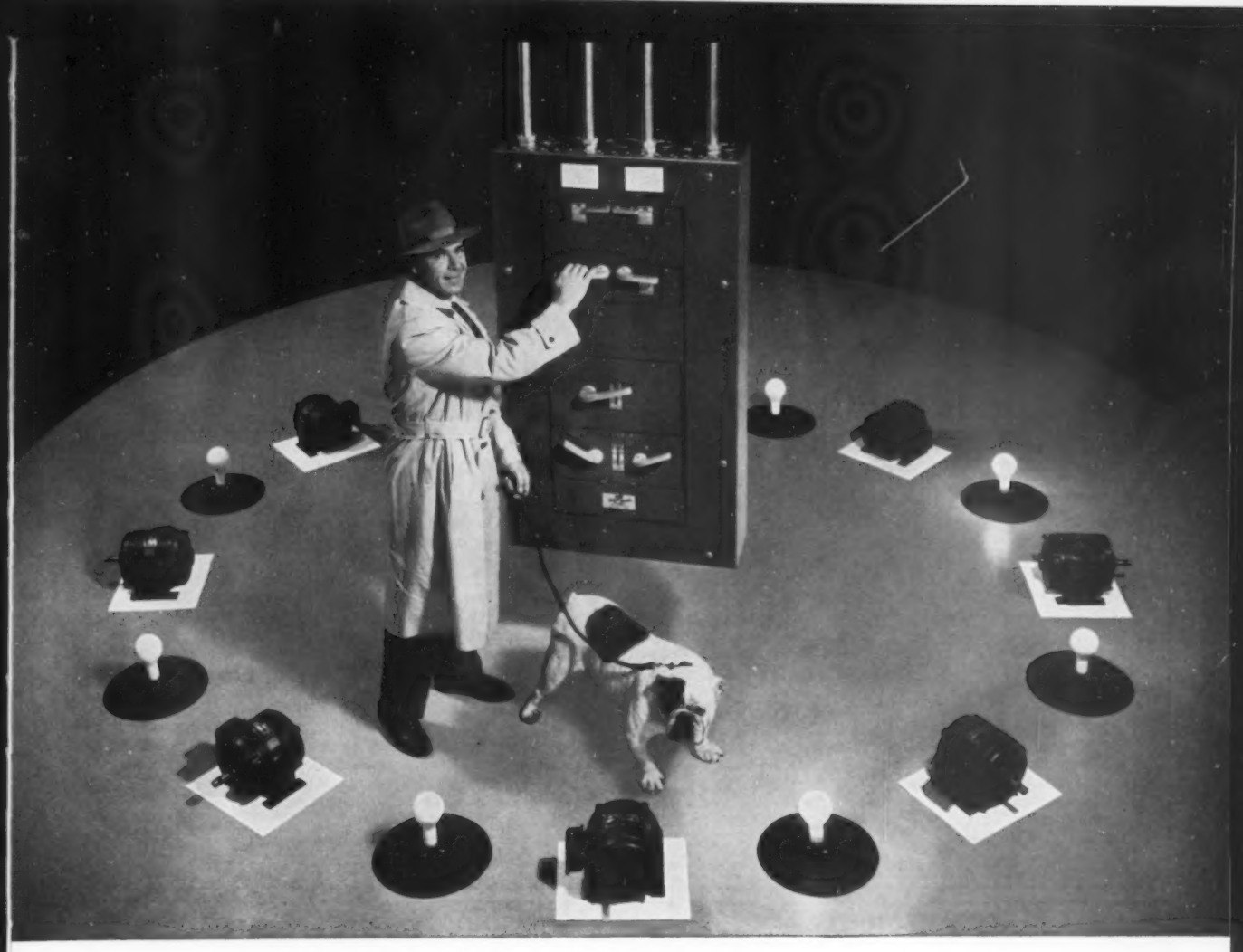
The paper power cable inside matches the extra quality of the sheath. And that's the whole story—there's simply no better cable buy, when the cable you use has to last, then last some more!

Test data and an informative folder about the exceptional properties of this sheath are available. Write: Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey

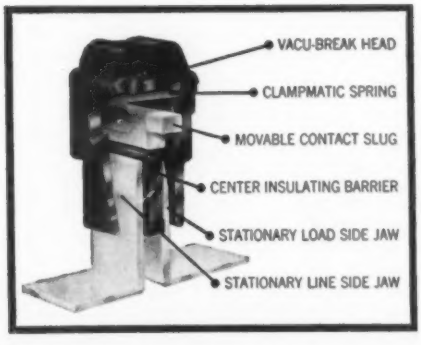
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roebling electrical wires and cables are available with either copper or aluminum conductors.



Compact central power control—*with Vacu-Break protection*



VACU-BREAK CONTROL snuffs arcs immediately when breaking circuits under load. The enclosed head limits the oxygen available during the brief arcing period. Closeness of the head material causes the arc to cool and extinguish quickly. "Double-break" action reduces the distance the Vacu-Break head must travel before the arc is extinguished. In addition, Clampmatic action assures bolt-tight contacts, accelerates breaks.

BullDog Vacu-Break® Power Panels provide the efficient, economical way to centralize lighting and power distribution. One compact panel controls a host of lights and motors . . . saves space . . . provides real circuit flexibility.

BullDog Power Panels are prefabricated . . . switch units are standardized and interchangeable. Units are available from 30 to 600 amperes. It is simplicity itself to convert the panels when circuit requirements change.

Exclusive Vacu-Break control snuffs arcs quickly . . . Clampmatic® action assures quick-make, quick-break, bolt-tight switching connections—longer equipment life. Find out about BullDog Power Panels from your electrical distributor or BullDog field engineer, or write BullDog direct. © BEPCO

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company, Detroit 32, Mich. *BullDog Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

HEAT BETTER ELECTRICALLY

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
2930 Commerce St., P.O. Box 1725
Houston, Texas

Standard Electric Mfg. Co.
2401 Federal St., P.O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N.W., P.O. Box 8, Sta. D
Atlanta, Georgia

New, revised estimating tables continued in this issue

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

LUGS - SOLDER

SIZE INCHES	AMP	HOURS EACH	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
			$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
3/16	25	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
1/4	35	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
5/16	50	.18	.225	.27	.315	.36	.405	.45	.495	.54	.585	.63	.675
3/8	70	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
7/16	90	.22	.275	.33	.385	.44	.495	.55	.605	.66	.715	.77	.825
1/2	125	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
9/16	150	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
5/8	175	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
11/16	225	.27	.338	.405	.473	.54	.608	.675	.743	.81	.878	.945	1.01
13/16	250	.27	.338	.405	.473	.54	.608	.675	.743	.81	.878	.945	1.01
15/16	325	.27	.338	.405	.473	.54	.608	.675	.743	.81	.878	.945	1.01
1	362	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
1 1/16	400	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
1 1/8	450	.32	.40	.48	.56	.64	.72	.80	.88	.96	1.04	1.12	1.20
1 5/16	550	.32	.40	.48	.56	.64	.72	.80	.88	.96	1.04	1.12	1.20
1 7/16	650	.35	.438	.525	.613	.70	.788	.875	.963	1.05	1.14	1.23	1.31
1 3/4	850	.35	.438	.525	.613	.70	.788	.875	.963	1.05	1.14	1.23	1.31
2 1/16	1050	.37	.463	.555	.648	.74	.83	.925	1.02	1.11	1.20	1.30	1.39
2 7/8	1200	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50

E-101-B

LABOR: Includes preparatory time, stripping conductor or conductors, setting lugs, dipping and screwing lug to device.

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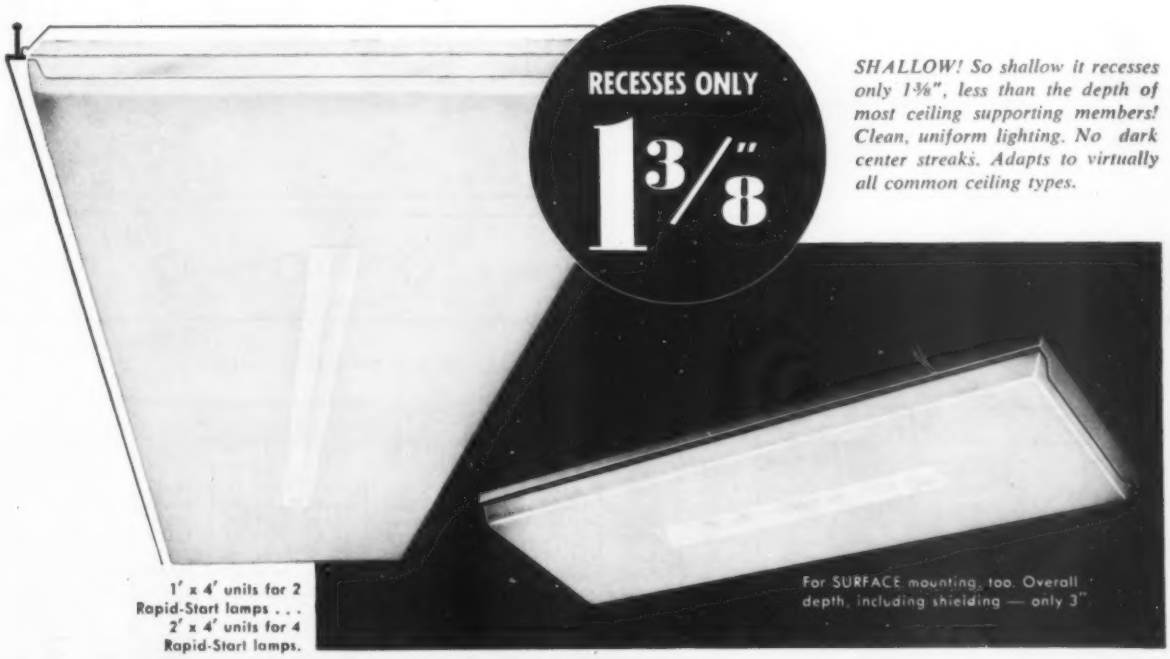
COUNTDOWN

ON INSTALLATION TIME WITH

the NEW *Smithcraft* SLENDEX

A troffer so shallow it handles like tile! Designed to cut costs where it counts — on installation and maintenance time! Slender, sleek styling complemented by unique engineering features . . . SLENDEX requires no extra depth for tilting . . . goes into the ceiling FLAT. Solves acute ceiling space conditions . . . simplifies your lighting job.


RECESSES ONLY
1 3/8"
1' x 4' units for 2 Rapid-Start lamps . . .
2' x 4' units for 4 Rapid-Start lamps.
For SURFACE mounting, too. Overall depth, including shielding — only 3"

SHALLOW! So shallow it recesses only 1⅜", less than the depth of most ceiling supporting members! Clean, uniform lighting. No dark center streaks. Adapts to virtually all common ceiling types.

SLENDEX SOLVES TOUGH CEILING PROBLEM! Selected from the offerings of 14 other manufacturers: Smithcraft SLENDEX. 100 SLENDEX 2' x 4' units, installed in the testing laboratory of one of the nation's largest steel companies. Low ceiling (7' 6" at lowest point), minimum cavity (only 1½" in depth).

Write today for the complete Smithcraft Catalog.

Smithcraft

LIGHTING

CHELSEA 50, MASSACHUSETTS

"America's Finest Fluorescent Lighting"

LUGS - SOLDERLESS

SPLIT SLEEVE OR CLAMP TIPE

LUG SIZE	Hours EACH	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
8	.21	.263	.315	.368	.42	.473	.53	.58	.63	.68	.74	.79
6	.27	.338	.405	.473	.54	.61	.68	.74	.81	.88	.95	1.01
4	.32	.40	.48	.56	.64	.72	.80	.88	.96	1.04	1.12	1.20
2	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
1/0	.42	.53	.63	.74	.84	.95	1.05	1.16	1.26	1.37	1.47	1.58
2/0	.48	.60	.72	.84	.96	1.08	1.20	1.32	1.44	1.56	1.68	1.80
3/0	.53	.66	.80	.93	1.06	1.19	1.33	1.46	1.59	1.72	1.86	1.99
4/0	.58	.73	.87	1.02	1.16	1.31	1.45	1.60	1.74	1.89	2.03	2.18
250 CM	.64	.80	.96	1.12	1.28	1.44	1.60	1.76	1.92	2.08	2.24	2.40
300 "	.69	.86	1.04	1.21	1.38	1.55	1.73	1.90	2.07	2.24	2.42	2.59
350 "	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
400 "	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80	3.00
500 "	.85	1.06	1.28	1.49	1.70	1.91	2.13	2.34	2.55	2.76	2.98	3.19
750 "	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38
1000 "	.95	1.19	1.43	1.66	1.90	2.14	2.38	2.61	2.85	3.09	3.33	3.56
1250 "	1.0	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75
1500 "	1.1	1.38	1.65	1.93	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13
1750 "	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.05	3.33	3.61	3.89	4.16
2000 "	1.2	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20	4.50

E-101-B

LABOR: Includes stripping conductor, setting lug & attaching lug to terminus

10-58

MOTOR INSTALLATION - MOUNTING & CONNECTING - 110 VOLT INSTALLED ON FLOORS

MOTOR SIZE	HRS. EACH	LABOR COST EACH INSTALLED AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1/4	3.5	4.38	5.25	6.13	7.00	7.88	8.75	9.63	10.50	11.38	12.25	13.13
1/3	3.9	4.88	5.85	6.83	7.80	8.78	9.75	10.73	11.70	12.68	13.65	14.63
1/2	4.4	5.50	6.60	7.70	8.80	9.90	11.00	12.10	13.20	14.30	15.40	16.50
3/4	4.8	6.00	7.20	8.40	9.60	10.80	12.00	13.20	14.40	15.60	16.80	18.00
1	5.4	6.75	8.10	9.45	10.80	12.15	13.50	14.85	16.20	17.55	18.90	20.25
1 1/2	6.1	7.63	9.15	10.68	12.20	13.73	15.25	16.78	18.30	19.83	21.35	22.88
2	6.9	8.63	10.35	12.08	13.80	15.53	17.25	18.98	20.70	22.43	24.15	25.88
3	8.0	10.00	12.00	14.00	16.00	18.00	20.50	22.00	24.00	26.00	28.00	30.00
5	10.0	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00	37.50
		110 VOLT MOUNTING AT 10 FT. HEIGHT										
1/4	4.6	5.75	6.90	8.05	9.20	10.35	11.50	12.65	13.80	14.95	16.10	17.25
1/3	5.1	6.38	7.65	8.93	10.20	11.48	12.75	14.03	15.30	16.58	17.85	19.13
1/2	5.8	7.25	8.70	10.15	11.60	13.05	14.50	15.95	17.40	18.85	20.30	21.75
3/4	6.4	8.00	9.60	11.20	12.80	14.40	16.00	17.60	19.20	20.80	22.40	24.00
1	7.	8.75	10.50	12.25	14.00	15.75	17.50	19.25	21.00	22.75	24.50	26.25
1 1/2	7.9	9.88	11.85	13.83	15.80	17.78	19.75	21.73	23.70	25.68	27.65	29.63
2	9.	11.25	13.50	15.75	18.00	20.25	22.50	24.75	27.00	29.25	31.50	33.75
3	10.6	13.25	15.90	18.55	21.20	23.85	26.50	29.15	31.80	34.45	37.10	39.75
5	15.2	16.50	19.80	23.10	26.40	29.70	33.00	36.30	39.60	42.90	46.20	49.50

E-102-B

LABOR: Includes preparation time, handling motor at site, setting to position, securing in place and connecting taps.

10-58

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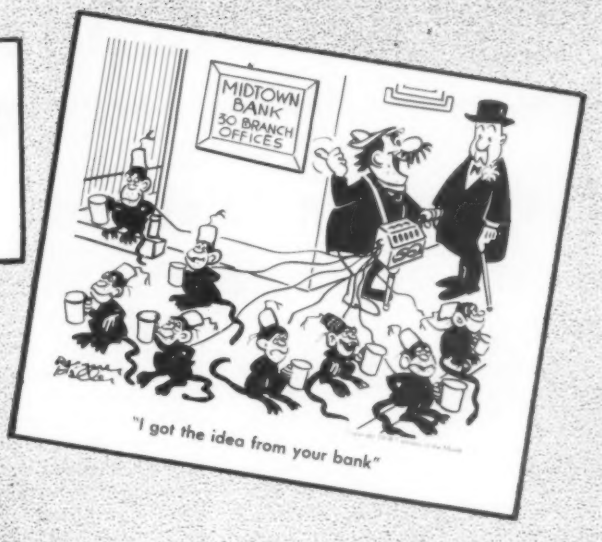
Your Work Can Wait!



"I got the idea from your bank"

"When I persuaded him to take up a hobby, I thought it would take his mind off business!"

"You haven't picked up a space satellite, Ed... that constant beep you hear is some fellow honking for daughter to hurry up!"

"Sooner or later, I knew some loafer would sneak a TV set in there!"

Contractors tell how

Post lantern sales plan meets gas competition

◆ PARTICULARLY effective in Shreveport, La., has been a sales plan designed to promote electric post lanterns in competition with the gas post lanterns that have been sold in considerable numbers in the Southwest for outdoor lighting.

The plan was developed by the Southwestern Gas and Electric Company in cooperation with local electrical wholesalers and the electrical contractors' association. The promotion covers an electric post lantern that can be sold for $39.95, including a frosted glass chimney and one lamp bulb. The price included installation in the metropolitan area of Shreveport provided the installation did not require more than fifty feet of underground cable, and it also included one indoor switch. Additional cable would be furnished and laid at twenty-five cents per foot. To protect the contractors against unusual and difficult installations, it was further stipulated that where necessary to run cable under drive ways, hedgerows, or other obstructions an additional charge would be made.

All this information, together with an attractive cut of the two styles of lanterns were put in a five-column newspaper advertisement. The ad also carried the information that the post lanterns could be bought for a down payment of $3.95, the balance payable as low as $3 per month on the customer's light bill.

Results were obtained almost immediately, according to Frank C. Camus, a participating contractor, who operates the C & C Electric Co., at 1302 Louisiana Ave. The telephone began ringing the morning the ad appeared, and the company is still getting calls about post lanterns.

"We made sales right from the start," he states. "And one remarkable thing we noticed was that many of them were to people we hadn't known before. A lot of them, too, bought other fixtures, and any plan that promotes that kind of business is a good one.

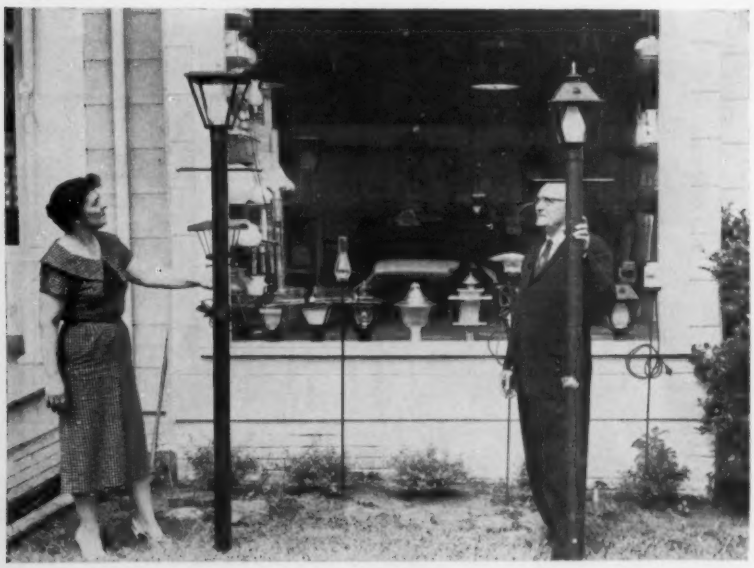
"A lot of the phone calls we got were from people who, for one reason or another, couldn't get down to see the lamps during business hours. That led us to install two post lanterns out on the lawn before our place of business so that people can see and inspect them there any hour of the day or night. We think that has helped sales considerably."

Was the margin as great on post lanterns as on some other items?

"I don't mind telling you there's a good profit in them," Mr. Camus said. "Here's a one unit deal we handled yesterday. Base price of one lantern with indoor switch and fifty feet of cable, $39.95; 20 extra feet of cable $5.00; total $44.95. Our cost on the post lantern is $11.35; on 70 feet of cable, $5.90; and labor cost, $7.75. That makes our total cost $25. Deducting that from the $44.95 billed to customer leaves $19.95 to cover overhead and profit.

"A lot of customers buy more than one post lantern," he continued. "Here's one where we sold two and used a hundred and thirty feet of extra cable. It all came to $112.75 and our margin was $46.50."

Mr. Camus freely admits that no one is going to get rich selling post lanterns. He does feel, however, that they have been responsible for a lot of profitable business, some of it new business. The idea was a good one, and a fine example of the cooperation that exists in Shreveport between the contractors, wholesalers, and the utility company.



Mr. and Mrs. Frank C. Camus, of C and C Electric Co., Shreveport, point out the type of post lantern that has figured prominently in a cooperative promotion plan designed to develop new business.

Synthetic rope aids cable pull through conduit

◆ ROPE stranded from Mylar, a new DuPont polyester film with remarkable strength properties, may have solved the major electrical contracting problem of pulling cable through conduit. In a recent test, four electrical cables weighing more than 1,200 pounds were pulled through a 162-foot length of 4-inch conduit with a Mylar rope only 3/8-inch in diameter. The conduit contained one 90-degree bend and two offsets.

Obtaining pulling lines that are strong, yet will not damage conduit, long has been a problem facing electrical contractors. Fiber ropes have been used with some success, but their life span was short and breakage often occurred when the pull was a long one. Steel cables were also tried, but when the conduit contained a bend, the cable frequently cut the pipe.

Manuals of national groups are helpful, time-saving

By James A. (Pete) Peterson
Cotton States Electric Co.
Atlanta, Georgia

◆ THIS COMPANY has been in continuous operation for 46 years; I have been with it 41 of those years, and have owned it since 1940. We have been lucky, I suppose, for in those 41 years I have seen the competition become so tight that it takes every bit of ingenuity a man has to stay in business and show a profit.

With financial conditions the way they are, and the governmental controls as stiff as they are, the contractor is wise to take advantage of every means at his command to learn the best prices for materials and the most profitable price to charge for them so that he can stay in business. Experience is a good teacher, of course, but a contractor needs authoritative advice in figuring the cost of and the proper price to charge for the hundreds of items in which he deals.

I have found this help and advice in the National Price Service Index, to which I have subscribed for a number of years, and it has helped me a great deal. This useful manual includes a complete index to all items a contractor might use, listing the various manufacturers' prices and the price a contractor should charge for that item. The index further shows these prices for under and over $100 worth of that item.

The book is in loose-leaf form and can be added to easily. The National Price Service sends supplements regularly, so that a contractor can keep up to date on costs of materials. In getting the book, the subscriber agrees to return all supplements for the past four months in the event he cancels his subscription.

My customers know I use this book as the basis for my prices, and it reassures them to know that mine are the prices recommended by an independent, national organization for the electrical industry. I believe in maintaining my price standards, and I do not lower those prices just to meet an impossibly low one quoted by a competitor, because I know that no long range good can come of doing business in that manner.

Another useful guide for the electrical contractor is the estimating manual issued by the National Electrical Contractors Association to its members. It contains tables telling the approxi-

(Continued on page 128)

Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electric Utilities ✔
Electrical Wholesalers ✔
Electrical Inspectors ✔
Industrial Engineers ✔
Consulting Engineers ✔

◆ I HAVE HEARD it said that the surest way to become a big wheel is to travel in large circles. Article 240 of the Code governing overcurrent protection appears to be short and compact—at first glance. But by the time all of the cross references have been run down, the searcher who runs them down may not end up as a wheel, but he is likely to display signs of dizziness, for he will have traveled in a full circle. There are those who will be inclined to ask themselves, "Is this trip necessary?" The answer is, "Yes."

Although some overcurrent devices are inherently complicated, the purpose for which they are used seems so overt and simple that many people believe themselves to be protected until the device upon which they are depending fails to function.

I am *not* referring to the "fiscal experts" who have discovered in the penny an economical method of increasing their housepower. I am referring to the electrical "expert" who dutifully installs a 125-ampere circuit-breaker in series with a 100-ampere load, connects this load to No. 1/0 Type TW wire rated to carry 125 amperes, installs the wire in rigid conduit, and connects the conduit to a concentric knock-out in such a manner and at such an angle that the strain pops out the next larger knock-out ring.

I am referring to this type of expert who doesn't bother to remake this connection in a workmanlike manner because he "knows" that the installation is "protected" by the "proper size breaker" and therefore is "safe."

In terms of safety, except in the case of a short-circuit, about the only difference in the two installations is the cost. The electrical expert's circuit-breaker costs more than the fiscal expert's penny. Neither will function properly as an overcurrent device under the conditions stated in the event of a fault to ground. The reasons for this "failure" of the overcurrent device will be explained in a discussion of equipment grounding in a later issue. It is mentioned here merely to emphasize that there is more to overcurrent protection than just putting in the right size fuse or circuit breaker!

Rules to keep in mind

Section 2403-a states, " . . . Plug fuses and fuse holders shall not be used in circuits exceeding 125 volts between conductors except in circuits supplied from a system having a grounded neutral and no

Code test questions

1. If the current-carrying capacity of a conductor does not correspond to the rating of a standard size fuse, a larger size up to and including 250% may be used. True or false?

2. A grounded conductor is considered to be protected from overcurrent if a protective device of a suitable rating is provided in each ungrounded conductor of the same circuit. True or false?

3. Plug fuses installed in residential occupancies are required to be of the time delay type. True or false?

4. Circuit-breakers of the 0 to 30 ampere class are required to be of the time delay type. True or false?

5. Adjustable-trip circuit breakers of the thermal trip, magnetic time-delay trip, or instantaneous-trip types shall be set to operate at not more than 150% of the allowable current-carrying capacity of the conductor. True or false?

6. Flexible cord approved for use with specific appliances shall be considered as protected by a 20-ampere branch circuit overcurrent device if it is:
(a) No. 18 or larger.
(b) No. 20 or larger.
(c) Not less than six feet in length.
Which is correct: a? b? c?

7. Flexible cord, when of 10-ampere capacity and when approved for use with specific appliances, shall be considered as protected from overcurrent by a branch circuit of:
(a) 50-ampere capacity.
(b) 40-ampere capacity.
(c) 30-ampere capacity.
Which is correct: a? b? c?

8. Flexible cord, when approved for use with specific appliances, shall be considered as protected from overcurrent by a 50-ampere branch circuit overcurrent device if it is:
(a) 20-ampere capacity or over.
(b) not less than six feet in length.
(c) at least 18 inches in length.
Which is correct: a? b? c?

9. Remote control conductors for a remote control switch shall be considered as protected from overcurrent by overcurrent devices:
(a) that are of the time-lag type and rated at not more than 500% of the carrying-capacity of the remote control conductors.
(b) that are not of the time-lag type and rated at not more than 500% of the carrying-capacity of the remote control conductors.
(c) which are connected in multiple.
Which is correct: a? b? c?

10. Which of the following is a standard rating for a non-adjustable-trip circuit-breaker?
(a) 25 amperes.
(b) 75 amperes.
(c) 125 amperes.
Which is correct: a? b? c?

Answers on page 138.

conductor in such circuits operating at more than 150 volts to ground. . . " Section 2451-a states, "Plug fuses of this type (Edison base type) shall be classified at not over 125 volts, 0 to 30 amperes." In applying these two sections of the Code, two other Code rules should be kept in mind. One of these rules is the Code definition of voltage to ground which is defined in Article 100 as follows:

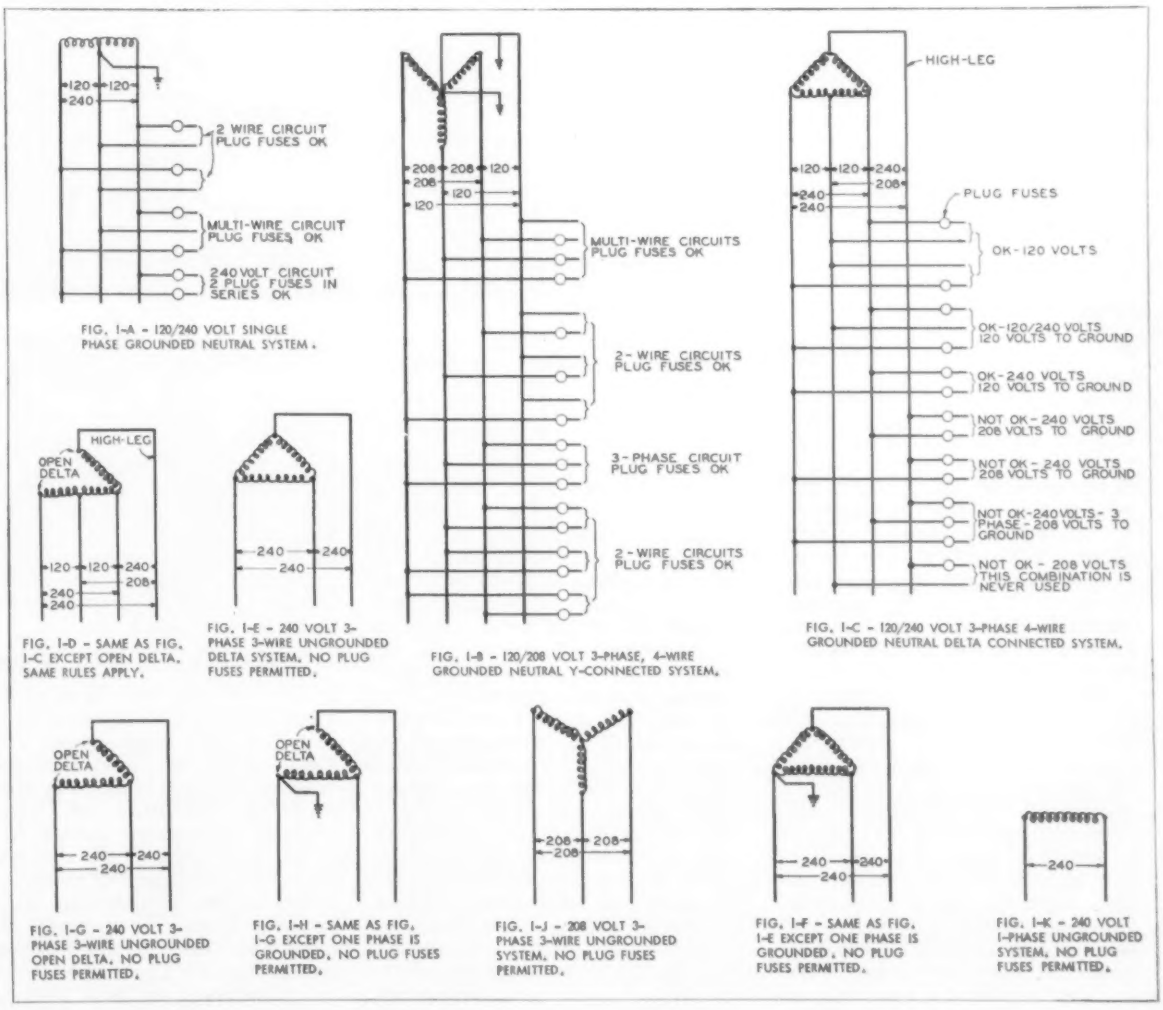
"In grounded circuits the voltage between the given conductor and that point or conductor of the circuit which is grounded; in ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit." (Don't overlook the difference in language used in this definition in referring to "grounded circuits" and the language above in section 2403-a which refers to circuits "supplied from a system having a grounded neutral." There is a difference.)

The other Code rule to keep in mind while applying the above two sections is the rule in section 2005-d which states, "If, on a 4-wire delta-connected secondary, the mid-point of one phase is grounded to supply lighting and similar loads, the phase conductor having the higher voltage to ground shall be identified by painting or other effective means at any point where a connection is made *if the neutral conductor is present.*" (Italics added.)

Here we have three Code rules which, if taken literally, would appear to be contradictory. It is in such cases as this that the intent of the Code must be followed. The third rule is one which makes it difficult, by reason of the portion which has been italicised above, for an inspector to determine whether the other three are in compliance unless the inspector happens to have his voltmeter with him at the time of the inspection.

Taken literally, section 2451-a limits the use of plug fuses to circuits of not over 125 volts, but section 2403-a extends this use to a 240-volt ungrounded circuit provided that this circuit is derived from a grounded system in which the voltage to ground is 120 volts (not over 150). But by definition, the voltage to ground on this ungrounded circuit must be taken as the voltage between conductors or 240 volts. Since this amount exceeds the maximum of 150, this would *not* be permitted. So by a literal reading of the Code, these contradictions appear to exist. The

Fig. 1—These diagrams show the permitted use of plug fuses as well as some applications which are not permitted by the Code.


120
120
240
2 WIRE CIRCUIT PLUG FUSES OK
MULTI-WIRE CIRCUIT PLUG FUSES OK
240 VOLT CIRCUIT 2 PLUG FUSES IN SERIES OK
FIG. 1-A - 120/240 VOLT SINGLE PHASE GROUNDED NEUTRAL SYSTEM.
208
208
120
120
MULTI-WIRE CIRCUITS PLUG FUSES OK
2-WIRE CIRCUITS PLUG FUSES OK
3-PHASE CIRCUIT PLUG FUSES OK
2-WIRE CIRCUITS PLUG FUSES OK
FIG. 1-B - 120/208 VOLT 3-PHASE, 4-WIRE GROUNDED NEUTRAL Y-CONNECTED SYSTEM.
HIGH-LEG
120
120
240
208
240
240
PLUG FUSES
OK-120 VOLTS
OK-120/240 VOLTS 120 VOLTS TO GROUND
OK-240 VOLTS 120 VOLTS TO GROUND
NOT OK-240 VOLTS 208 VOLTS TO GROUND
NOT OK-240 VOLTS 208 VOLTS TO GROUND
NOT OK-240 VOLTS-3 PHASE-208 VOLTS TO GROUND
NOT OK-208 VOLTS THIS COMBINATION IS NEVER USED
FIG. 1-C - 120/240 VOLT 3-PHASE 4-WIRE GROUNDED NEUTRAL DELTA CONNECTED SYSTEM.
OPEN DELTA
HIGH-LEG
120
120
240
240
240
208
FIG. 1-D - SAME AS FIG. 1-C EXCEPT OPEN DELTA. SAME RULES APPLY.
240
240
240
FIG. 1-E - 240 VOLT 3-PHASE 3-WIRE UNGROUNDED DELTA SYSTEM, NO PLUG FUSES PERMITTED.
OPEN DELTA
240
240
240
FIG. 1-G - 240 VOLT 3-PHASE 3-WIRE UNGROUNDED OPEN DELTA, NO PLUG FUSES PERMITTED.
OPEN DELTA
FIG. 1-H - SAME AS FIG. 1-G EXCEPT ONE PHASE IS GROUNDED, NO PLUG FUSES PERMITTED.
208
208
208
FIG. 1-J - 208 VOLT 3-PHASE 3-WIRE UNGROUNDED SYSTEM, NO PLUG FUSES PERMITTED.
240
240
240
FIG. 1-F - SAME AS FIG. 1-E EXCEPT ONE PHASE IS GROUNDED, NO PLUG FUSES PERMITTED.
240
FIG. 1-K - 240 VOLT 1-PHASE UNGROUNDED SYSTEM, NO PLUG FUSES PERMITTED.

intent, however, is clear enough.

Section 2451-a is a classification only. It means that a potential in excess of 125 volts shall not be placed across the fuse between the shell and the center terminal. Section 2403-a does not permit a greater potential than this in allowing two such fuses in series, one in each phase of a 240-volt circuit supplied by a grounded system on which the voltage to ground is actually 120 volts, the definition to the contrary notwithstanding. When used in this manner, there is never more than 125 volts across either fuse.

Inspector's difficulty

In a 3-phase, 4-wire, delta-connected system, however, plug fuses cannot be used on those 240-volt circuits derived from the phase with the higher voltage to ground and either of the other phases, because the voltage to ground on the "high-leg" is 208 volts.

And this is where the inspector's troubles start. Without a voltmeter, the inspector cannot look at a 240-volt circuit and determine whether it is composed of the two "normal" so-called "lighting legs" or whether it is composed of only one of these legs and the high-leg. This is because section 2005-d does not require the high-leg to be identified as such *unless the neutral conductor is also present.* Naturally, on 240-volt circuits, the neutral is not present.

As a result of this omission in the Code in not requiring identification of the high-leg in such cases, some inspection authorities will not permit the use of plug fuses on any 240-volt circuits if the high-leg is present on the premises. It is my personal opinion that both section 2005-d and the definition of voltage to ground on an ungrounded circuit should be reviewed by each of the Code Panels involved. The various diagrams shown in Figure 1 illustrate both correct and incorrect uses of plug fuses.

The Code recognizes both adjustable-trip and non-adjustable-trip circuit-breakers except for use as the overcurrent protection for branch circuits as defined in Article 210. Circuit-breakers used for the protection of such branch circuits are required to be of the non-adjustable-trip, non-tamperable type. Unlike a non-adjustable-trip circuit-breaker which will not trip unless the current exceeds the rated value of the breaker, an adjustable-trip circuit-breaker will trip when the current reaches a value equal to the setting of the breaker.

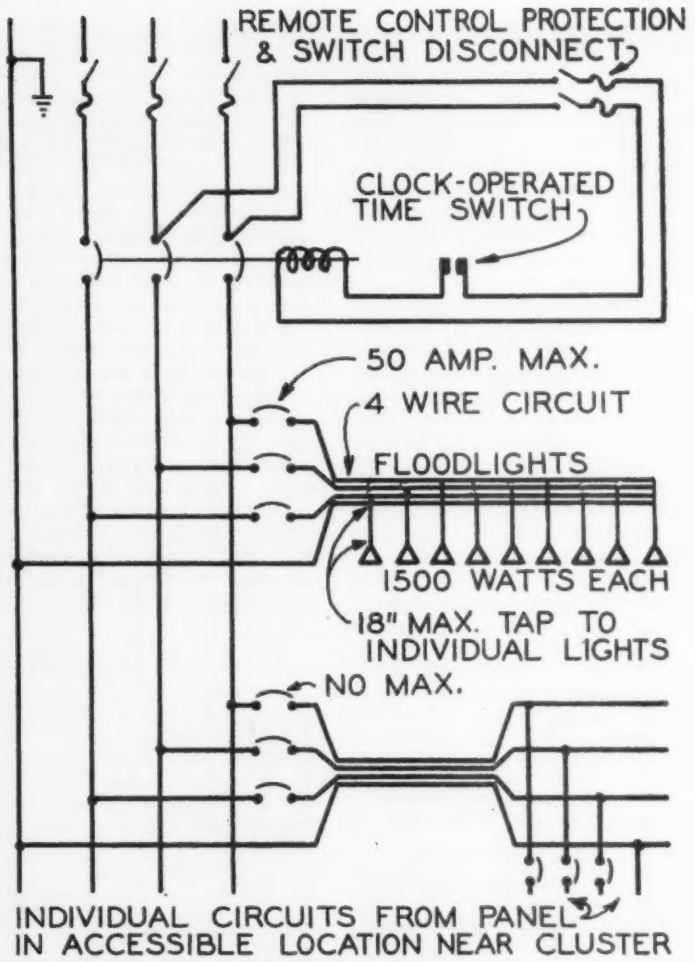


Fig. 2—Correct wiring for a floodlight installation served from a 120/208 three-phase four-wire grounded neutral system.

Cords, when used as intended, that is as a part of a portable appliance or lamp with a fixed load, are not likely to become overloaded. When this use is extended in a manner all too familiar to most of us, a contention, or pretention, that safe overcurrent protection exists on such cords is pure deception. Fires which have resulted from high-resistance faults on such cords are far too numerous to be ignored. There is nearly always enough current flowing at such faults to ignite the building or its contents, but seldom enough to cause the overcurrent devices to operate and clear the faults.

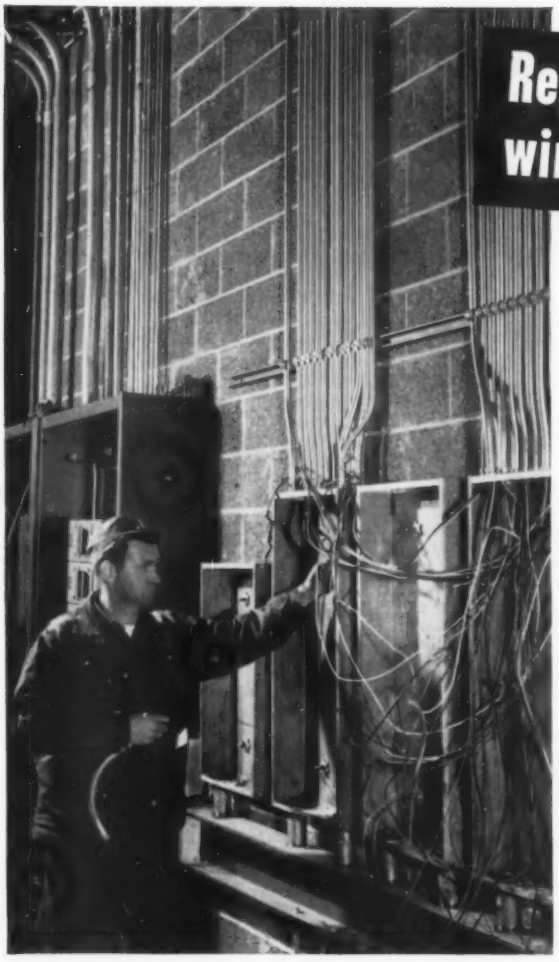
At least one means of overcoming this hazardous and prevalent condition would be the requirement for a sufficient number of convenience outlets to remove the need for such cord extensions, not only in dwellings as now required by the present Code, but also in all other types of occupancies where portable or plug-in equipment is likely to be used.

Floodlight wiring often wrong

There is one type of electrical installation which I have found installed incorrectly time after time, often by electrical contractors who are careful, in other types of installations, to comply with all Code requirements. This is the installation of floodlighting projects, such as at ball parks.

The use of floodlighting is increasing from year to year. Not only are floodlights used in ball parks, but the flooding of build-

(Continued on page 138)



Republic ELECTRUNITE makes wire pulling up to 30% easier

further proof that

THE BEST COSTS LESS INSTALLED

With Republic ELECTRUNITE® E.M.T., quality and economy go hand-in-hand. ELECTRUNITE E.M.T. is produced from highest quality flat-rolled open-hearth steel made in Republic's own mills and carefully inspected to meet Republic's rigid requirements. The result is a tube with uniform ductility—ductility that provides wrinkle-free bends without wall collapse . . . every time. It offers three other major installation advantages:

1. Exclusive "INSIDE-KNURLING" . . . ball-bearing like surface that reduces friction, makes wire pulling as much as 30% easier.

2. Exclusive "INCH-MARKS®" in feet and inches on all sizes up to 1¼" . . . reduce measuring and fitting time. Simply measure, cut, and install!

3. "GUIDE-LINED", in sizes ½" through 1¼", from end-to-end, to keep bends in line, avoid "wows", wasted time and materials.

That is why Republic ELECTRUNITE E.M.T. was used throughout the construction of the new Lincoln Park Shopping Center, Lincoln Park, Michigan.

Republic ELECTRUNITE E.M.T. is produced to meet building code requirements—A.S.A. Specification C.80.3, Federal Specification WW-T-806 (latest revisions), and carries the Underwriters' Laboratories Seal of Inspection.

Learn more about ELECTRUNITE advantages. Call your Republic ELECTRUNITE distributor, or write today.

Lincoln Park Shopping Center, Lincoln Park, Michigan
Architect: Sidney H. Morris and Associates, Chicago, Ill.
General Contractor: Charleston Construction Company, Detroit, Mich.
Electrical Contractor: W. D. Gale Company, Detroit, Mich.

REPUBLIC STEEL
STEEL AND TUBES DIVISION

REPUBLIC STEEL

Cleveland 8, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-6061-A
227 EAST 131st STREET • CLEVELAND 8, OHIO

I would like to learn more about Republic ELECTRUNITE features and installation advantages.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

News of the industry

edited for Southern readers

NECA convention set for November in Dallas

A PROGRAM BUILT around the theme, "Electrical Contracting is Our Business," is expected to attract more than 2,500 electrical contractors and their guests to the 57th anniversary convention of the National Electrical Contractors Association at the Dallas Memorial Auditorium the week of November 16.

Convention activities commence the preceding week with meetings of the NECA executive committee. The board of governors will meet Nov. 17 and 18, and the general membership business sessions of the convention begin Wednesday morning, Nov. 19, concluding Saturday night with the Annual Banquet. The business program will be concerned with defining and explaining the function of the electrical contractor.

NECA president, Oliver F. Burnett, will address the meeting the opening day. The featured speaker of the convention will be Tony Whan of the Pacific Outdoor Advertising Co., Los Angeles, Calif.

The exposition which opens the evening of Nov. 18, will be almost double the size of last year's trade show. Approximately 150 manufacturers of electrical materials, equipment, apparatus, and tools have reserved spaces in the auditorium for display of their products.

The reception the evening of Nov. 18 will take the form of a frontier party. The annual banquet on Saturday evening will be at the Baker and Statler-Hilton Hotels, and an informal get-together with dancing and entertainment will be held the evening of Nov. 21 at the Adolphus Hotel. November 20 there will be a luncheon with a Neiman Marcus Style Show for the ladies.

Promotion stepped up on adequate wiring

IN THE FALL ISSUE of the Housepower bulletin plans were set forth for an all-out national advertising campaign by Horsepower to acquaint the public with the need for better wiring in the home. It was announced that two of the nation's biggest names in the media of mass advertising, the *Reader's Digest* and National Broadcasting System's week end radio program Monitor, will be utilized by the promotional organization.

Announcement was also made in the bulletin that a kit helpful to local advertisers has been prepared and made available to the electrical industry by the wiring promotion committee of Edison Electric Institute in cooperation with the National Wiring Bureau.

The Reader's Digest ad features a two-page, editorial-type coverage telling the story of Housepower and stressing its theme of better living the electric way. Time for 147 announcements during the week-ends of Sept. 6-7 and Sept. 13-14, has been secured over the NBC program Monitor. These week-ends were chosen because they surround National Home Week.

In addition, seven pages of advertisements will be seen in the *Saturday Evening Post, Better Homes and Gardens,* and *Sunset.*

In the kit now available to interested members of the electrical industry, help has been offered to advertisers in coordinating their local campaigns with the national publicity work.

Complete information to aid local members of the electrical industry complete their own publicity plans is given in a yellow-paged booklet which lists all necessary merchandising materials such as counter dispensers, window banners, and folders.

Power Use meeting featured electric heating

ELECTRIC space heating led the parade of new ideas in electric farming and living at the fifth annual National Power Use Conference at Buffalo, New York, October 5, 6, and 7. More than 1,000 delegates representing rural electric cooperatives, power companies, public power districts, and national trade associations attended the sessions sponsored by the Inter-Industry Farm Electric Utilization Council.

Keynote speaker was David A. Hamil, administrator of the Rural Electrification Administration, who discussed the impact of changes in the nation's agricultural economy on distributors of electric power. His address stressed the importance of maintaining a united front in the electric industry to meet ever-increasing service demands.

The Conference threw its spotlight on electric space heating, which is tagged "tomorrow's big load" in the drive toward all electric homes. Six top experts were on hand to discuss resistance heating, heat pumps, proper insulation, sales methods, and establishment of effective standards.

Two additional major presentations of the conference dealt with free service entrances, and the servicing of electric appliances and equipment in rural areas.

AP&L'S NEW DIVISION OFFICE—Arkansas Power and Light Company's new Northeast Division office in Searcy, Arkansas, is lighted to maximize the structural highlights of the building. Two mercury-vapor floodlights (400-watt and 1000-watt) illuminate the face of the building. Focused on the company emblem are two 300-watt incandescent reflector flood lamps, emphasizing the aluminum block letters.

Johannesen chairman of NEW plan committee

R. M. JOHANNESEN, president of Johannesen Electric Company, Inc., Greensboro, N. C., has been selected as chairman of the National Electrical Week plan committee. Johannesen succeeds Herbert E. Cook, executive secretary of the Electrical Association of Detroit.

An active participant in electrical industry organizations, Johannesen has served on the National Electrical Week committee since the week became an all-industry event three years ago. He was president of the National Association of Electrical Distributors in 1953-54, served as a member of the board and of the executive committee from 1947 to 1955, and was vice-president for three terms. He is presently serving on various national NAED committees.

Trade Conference scheduled for February

PLANS FOR THE SECOND biennial Electrical Trade Conference, scheduled for Feb. 17-19, have been completed. The three-day conference will be under the joint sponsorship of the Electrical Manufacturers Representatives Association of Baltimore and Washington and the Electric Institute of Washington. The meeting is designed to bring exhibitors an accurate picture of the latest developments in the electrical industry and to assist in the promotion and sale of electrical products and services.

The Electrical Trade Show is expected to attract the top purchasers of every type electrical equipment and service in the Washington, D. C., Richmond, and Baltimore markets. Federal and municipal government supervisory personnel have been invited to attend the exhibits. Architects, contractors, construction men, engineers, utility executives, specification writers, and plant maintenance men will be interested in viewing this highly concentrated assortment of goods and services.

Brief news notes of manufacturers

THE RECENTLY ANNOUNCED decision by Hubbard and Company to consolidate the manufacture of pole line hardware at its Chicago and Oakland, California, plants is part of a comprehensive expansion and modernization program initiated some years ago. The program is rapidly nearing completion.

Also, the warehouse and ship-

ARROW AH HART

ADD-ON

ARROW-HART
100 Amp.
SERVICE

. . . maximum flexibility at minimum cost!

Now, with Arrow-Hart's *flexible* 100 Amp. Service Equipment, you can — at low cost — provide your customer with a service unit that will meet his present — and *future* — electrical needs. Both a Small Enclosure (8 to 12 circuits) and a Large Enclosure (12 to 20 circuits) are available.

Design features benefit both you and your customer. Parts are clearly marked to assure easy, correct assembly and installation. Add-On Branch Circuits are supplied with captive screws (for positive contact) already in place. No need to rely on stab-type tension alone for attachment. Neutral strips, located to eliminate looping and U-bending, and to save wire and wiring time, can be grounded or insulated.

Write for free copy of Folder No. A-228 to The Arrow-Hart & Hegeman Electric Company, Dept. ES, 103 Hawthorn Street, Hartford 6, Connecticut or . . .

See Your Authorized Arrow-Hart Distributor

ARROW AH HART

Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

ping facilities at Plano, Texas, have also been improved and added to, with ample space and facilities available for future expansion.

Another major step in this comprehensive program was the decision to move the executive offices from Pittsburgh to Chicago's Borg-Warner Building. The general offices of Hubbard and Company, now established at the Chicago plant, 5401 West Roosevelt Road, have been modernized in every respect. New, high-speed accounting procedures and facilities have been installed throughout for fast, efficient handling of orders and customer service.

* * *

ROBBINS & MYERS, Inc., Springfield, Ohio, electric motor manufacturer, has purchased Trade-Wind Motorfans, Inc., Pico Rivera, Calif. The sales force of Trade-Wind will remain intact but will be directed from the Hunter Division-Robbins & Myers in Memphis.

* * *

ESSEX WIRE CORP., Fort Wayne, Ind., has moved its Dallas warehouse and office operations into a new 12,000-square-foot building in the Dallas Brook Hollow industrial district. The new warehouse will house the entire line of electrical wires and cables produced by the Paranite Wire and Cable Division of Essex.

* * *

PYLE-NATIONAL COMPANY, of Chicago, pioneer manufacturer of electrical connectors, fittings and lighting equipment, has contracted to acquire the Steber Manufacturing Co., of Broadview, Ill., a major producer of outdoor lighting fixtures and lighting equipment, it was jointly announced today by William C. Croft, president of Pyle-National, and Clarence L. Steber.

Croft reported that Steber Manufacturing would continue its operations as a division of the Pyle-National organization.

NEW REVERE PLANT COMPLETED—The new plant of Revere Electric Manufacturing Company, manufacturers of industrial and commercial outdoor lighting equipment, gives the firm nearly double the floor space of their former plant. The plant was occupied by Revere in early June, and features enlarged and improved research, manufacturing, and warehouse facilities. It is located at 7420 Lehigh Ave., Niles, Illinois.

Manufacturers appoint new representatives

BERT BEREND of Miami Beach, Fla., is the latest addition to the sales representative roster of Sunbeam Lighting Company, Los Angeles, Calif. and Gary, Ind. Berend's headquarters will be 1125 Marseille Dr., Miami Beach, Fla.

* * *

THE EDWARDS COMPANY has recently appointed William P. Adams to the Atlanta regional office. Adams will serve as field representative in Alabama, South Carolina, Tennessee, and portions of Georgia. Other appointments to the Atlanta office were William W. Kreidler and Lawrence A. Day.

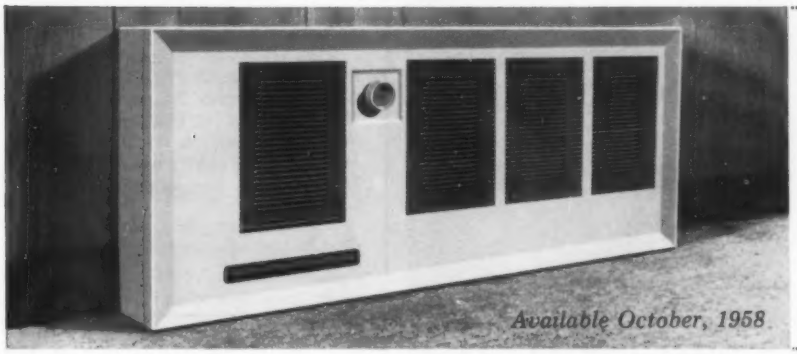
William P. Adams

MOBILE EQUIPMENT DEMONSTRATOR—S & C Electric Company's distribution equipment mobile demonstrator, which shows actual physical operating of disconnects, cutouts, loadbuster, fuse links, and handling tools, currently is being sent out in the field to show electric utilities the ways of achieving maximum safety in the operation of distribution equipment. The demonstrator carries its own collapsible cross arm "pole"—an aluminum frame which takes the equipment 12 feet above the ground.

Big News FROM R&M-HUNTER

Electric Heating-Forced Air Heating-Baseboard Heating- *All in one Packaged Unit!*

FORCED AIR BASEBOARD: A new concept in electric heat



- Remove this R&M-Hunter Baseboard unit from its carton and install in minutes
- No parts to assemble
- No long baseboard sections
- Positive circulation without drafts

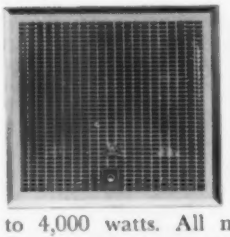
Mr. Contractor, here is electric heat at its best. Best for the home-owner. Best for you. No parts and pieces to assemble. Out-of-line walls are no problem. Just remove the R&M-Hunter Forced Air Baseboard Heater from its package and install in a matter of minutes.

R&M-Hunter Forced Air Baseboard Heaters go in at floor level in either new or existing construction. Frame and facing finished in beige. Heater is available with or without built-in thermostat control. Thermostat model will regulate one or more units.

Tempered air is discharged in an ascending 30° fan pattern. Quiet centrifugal fan recovers floor level air which in turn pulls the warmed ceiling air down into the living zone. Floor and ceiling temperatures are equalized within very close tolerances. Wasteful heat packing at ceiling is minimized.

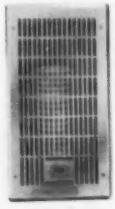
Get the full profit story on R&M-Hunter Forced Air Baseboard Heaters from your distributor. Or write or call for complete information.

PROFIT WITH THESE OTHER R&M-HUNTER QUALITY ELECTRIC HEAT PRODUCTS



Automatic Recessed Wall Heaters

Styled by Sheldon Rutter, these heaters improve room appearance with their fine decorator styling. Beige grille has smart, anodized gold frame. Four capacities: 1500 to 4,000 watts. All models mount flush to wall. Thermostat controlled. Cradled coil element guaranteed 5 years against burn-out. Now available.



Bathroom Heater

Instant radiant heat chases bathroom chill at the flick of a switch. Compact design will fit into crowded space without sacrificing desirable location of fixtures. Sparkling chrome finish. Cradled coil nichrome element guaranteed 5 years. Now available.

Baseboard Heat Sections and Accessories

Provided in 32" and 48" modular lengths. New, improved heating elements, fully enclosed, produce 200 watts per lineal foot. Thermostatic Control Section, Convenience Outlet Sections, End Caps and Corner Pieces combine to make R&M-Hunter Baseboard Sections highly flexible for any space arrangement. Sections only 2-1/16" thick, 6" high. Now available.

R&M HUNTER

HUNTER DIVISION-ROBBINS & MYERS, INC.
2644 Frisco, Memphis, Tenn.
The Peak of Quality

R&M-HUNTER ELECTRIC HEAT . . . *It's Matchless!*

have your

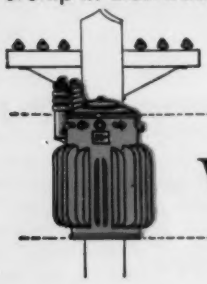
Westinghouse representative

tell you how you can

HANDLE PRESENT DISTRIBUTION LOADS LONGER ...NO ADDITIONAL INVESTMENT

Now—the Insuldur® insulation system assures you of increased transformer life, without additional cost . . . Another answer to changing needs because Plowback of earnings into research maintains Westinghouse leadership in distribution transformer development.

J-70846



YOU CAN BE SURE...IF IT'S

Westinghouse

ARROW CONDUIT & Fittings Corp., of Brooklyn, N. Y., and Arrolet Corp., of Montgomery, Pa., announce the appointment of the following regional sales representatives: for Georgia: Cary Chapman & Co., 672 Whitehall St., S. W., Atlanta; for Alabama and Tennessee: Cary Chapman & Co., 2516 Eighth Court North, Birmingham; for Louisiana and Mississippi: Cary Chapman & Co., 213 S. Front St., New Orleans; and for Kentucky and West Virginia: Block & Cooper, 1050 Meta Dr., Cincinnati 37, Ohio.

* * *

THE GALVIN SALES Company, 5622 Dyer St., Dallas 6, Texas, has been appointed sales representative in Texas for Spang Underfloor Wire Distribution Systems, manufactured by the Spang-Chalfant Division of the National Supply Company.

The company has served as conduit representative for the Spang-

Dates Ahead

Oklahoma Utilities Assn., Light and Power Conference: Eastern District, Western Hills Lodge, Lake Sequoyah, Wagoner, Okla., Oct. 16, 1958; Western District, Lawtonian Hotel, Lawton, Okla., Oct. 17, 1958.

Southeastern Electric Exchange, Engineering and Operation Section, Hotel Roanoke, Roanoke, Va., Oct. 20-21, 1958.

International Association of Electrical Inspectors, Southern Section Thirtieth Annual Meeting, McAllister Hotel, Miami, Fla., Oct. 20-22, 1958.

Power Distribution Conference, University of Texas, Austin, Tex., Oct. 20-22, 1958.

National Association of Corrosion Engineers, South Central Region Annual Conference and Exhibition, Roosevelt Hotel, New Orleans, Oct. 20-24, 1958.

Southeastern Electric Exchange, Sales Section, Biltmore Hotel, Atlanta, Ga., Nov. 12-14, 1958.

National Electrical Contractors Association, Annual Convention, Dallas, Texas, Nov. 19-22, 1958.

Oklahoma Utilities Assn., Annual Convention, Mayo Hotel, Tulsa, Okla., March 26-27, 1959.

Chalfant Division for a number of years. Personnel includes Dan M. Galvin, Dan J. Galvin, and Fred H. Copeland. A branch office is located in Houston.

* * *

NEW REPRESENTATIVES have been named by the Chester Cable Corp., of Chester, N. Y., to handle sales in two territories for the products of the company's Electronic Division.

The Branum Co., of Dallas, Tex., will handle sales in Oklahoma, Texas, Arkansas, and Louisiana. Appointed to cover Iowa, Kansas, Missouri, Nebraska, and a portion of Illinois, was the R. W. Farris Co., Inc., of Kansas City, Mo.

New Orleans District office established

WESTINGHOUSE Electric Corporation has increased the responsibilities of its New Orleans apparatus sales organization and appointed one of its key sales executives to the new post of district manager.

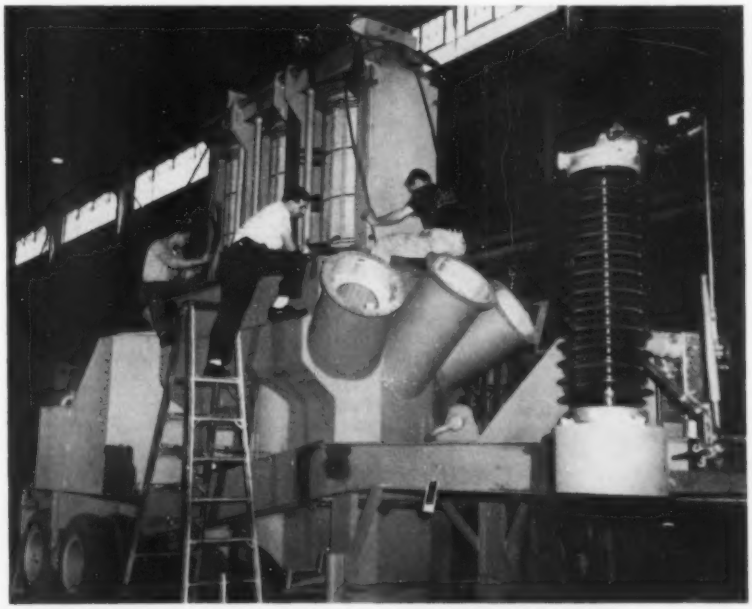
O. O. Rae, Westinghouse vice-president in charge of the company's southeastern region with headquarters in Atlanta, announced that the former New Orleans branch office now becomes a district office and will be managed by P. T. Lagrone, who formerly was manager of the electric utility sales department in Pittsburgh, Pa.

J. H. Bennett, former branch office manager, becomes assistant district manager in the new organization.

"This new district office has been established," Mr. Rae declared, "in recognition of the increasing commercial and industrial importance of New Orleans and the Mississippi-Louisiana area."

The southeastern region of the Westinghouse apparatus division now has four district offices—New Orleans, Atlanta, Birmingham, and Charlotte.

The new manager of the New Orleans district is a native of Ansley, La. Mr. Lagrone joined Westinghouse through the company's graduate student training course following his graduation from Louisiana State University in 1923. From 1926 to 1947 he was associated with the Mississippi Power and Light Company and returned to Westinghouse in 1947 as manager of the customer section, electric utility sales department.



"TRANSMOBILE" SUBSTATION—Photographed during the tanking operation, this 15,000-kva mobile substation will soon go into service for a Southwestern utility. The unit includes an autotransformer rated at 136-67 kv, a high voltage grounding switch, and control equipment. Rotating high voltage bushings and movable lightning arresters facilitate movement of the unit and permit highway clearances to be met. (Photo courtesy Penn. Transformer Div., McGraw-Edison Co.)

Now...
economic
change-out time
signaled
automatically

WITH
WESTINGHOUSE
CSP
DISTRIBUTION
TRANSFORMERS

Ask your Westinghouse representative for the CSP story . . . another answer to changing needs, created through Westinghouse leadership in distribution transformer development.

J-70851

YOU CAN BE SURE...IF IT'S

Westinghouse

News about people

Frank H. Roby has been appointed an executive vice president of **Federal Pacific Electric Company,** according to an announcement by the firm's board of directors.

Frank H. Roby

Before joining Federal Pacific, Mr. Roby was vice president and director of the **Square-D Company.** He had been associated with that firm since his graduation from Purdue University in 1933.

In 1950 Mr. Roby was elected a vice president and director, also serving on the board of Square-D Company Canada Ltd. and as managing director and board member of Square-D Ltd. of Great Britain.

As its new southern regional sales manager, **Day-Brite Lighting Inc.,** St. Louis, Mo., has appointed **Gordon Wells,** of Charlotte, N. C. Wells formerly represented Day-Brite in the states of Virginia and North and South Carolina. This area will now be served by his four lighting salesmen who will operate individual sales agencies as direct Day-Brite representatives. **John Manos** will be located in the Roanoke, Va., and Winston-Salem, N. C., trading areas.

Earl Dagenhardt

Roy Palmer, Jr., will handle Raleigh and Durham, North Carolina; **Earl Dagenhardt,** Richmond, Newport News and Norfolk, Va.; and **Ladd Massey** will represent Day-Brite in Charlotte, N. C., and Greenville, S. C.

Before becoming a Day-Brite representative 18 years ago, Gordon Wells was for 6 years a lighting engineer for the Georgia Power Company. He is a graduate of Georgia

Ladd Massey

School of Technology. His new position involves the sales management of 11 southern states including Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Arkansas, Tennessee, Kentucky, and Mississippi. His headquarters will continue to be 307-308 Builders Building, Charlotte 2, N. C.

Earl Dagenhardt has spent the last seven years in Virginia as a lighting salesman for the Wells Company. Ladd M. Massey joined Gordon Wells in 1950 after three years with an independent electric wholesaler as a lighting engineer. He is a 1947 graduate of Clemson University with a degree in electrical engineering.

Roy Palmer, Jr., has been with the Gordon Wells Company for two years. Before becoming a lighting salesman he spent a year at Day-Brite, in St. Louis, getting factory training. He is a graduate of Davidson College with a B. S. degree. John Manos also received his training at the Day-Brite plants in St. Louis and Tupelo, Miss. He has worked for the past year in the Charlotte office of the Gordon Wells Co., making lighting layouts and calling on local distributors and architects. He holds a B. A. degree from the University of North Carolina.

V. A. Elmblad, Southwestern District Manager for **Graybar Electric Co., Inc.,** announces the appointment of **E. J. Hoff** as manager at Fort Worth.

Mr. Hoff joined Graybar-Seattle in 1924 serving as part time janitor and stock records clerk while attending college. Since 1929 he has held various sales positions in Washington and Texas. He became manager of outside construction sales at Dallas in 1952 and in 1955 was made inside construction sales manager, the position held until his recent appointment.

Frank E. (Buzz) Harris, Jr., has been named assistant sales manager of the Tape Division of **Plymouth Rubber Co., Inc.,** Canton, Mass. Announcement of the appointment was made by James E. Fenn, division sales manager.

Mr. Harris is a Brown University graduate. He joined Plymouth three years ago, beginning as a sales assistant, and is thoroughly familiar with the products manufactured by the Tape Division.

Y. S. Hogg has been named manager of the Tampa district office for **Allis-Chalmers Manufacturing Co.,** Milwaukee, Wis. He joined A-C in 1949, shortly after his graduation from Alabama Polytechnic Institute, where he graduated with a B.S. degree in electrical engineering.

After completion of the Allis-Chalmers graduate training course in 1951, his first assignment was as a sales representative in the Atlanta district.

Gordon Wells

John Manos

Roy Palmer, Jr.

New products

Lightweight floodlight is mounted on pump island

CROUSE-HINDS Co., Syracuse 1, New York, presents the new MDB-10 pump island floodlight, a weatherproof, lightweight (4¼ lbs.) luminaire

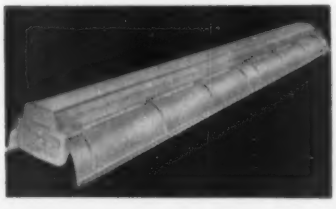
with a hinged door. Mounted on the pump island, the MDB-10 may be used to light driveways, building surfaces, or general areas.

With wide beam reflector, it is excellent for general area lighting, and when equipped with narrow beam reflector, it becomes an ideal spotlight for highlighting. Furnished with two feet of 2-conductor rubber-covered cable, the new floodlight takes 200-300-watt medium screw base general lighting service lamps.

For additional data, ask for item P-1014, using the coupon on page 139.

Industrial type fixtures are easily mounted and serviced

FLUORESCENT FIXTURES of California, 352 Shaw Road, South San Francisco, Calif., announce the new All-Brite line of industrial fixtures. The new line consists of RLM series 81, semi-direct and series 80 totally direct, equal in quality to



series 81 but not designed for RLM specifications.

Formed in one piece on All-Brite's new mammoth 300 ton hydraulic press brake, the reflectors are embossed with ribs for highest rigidity and torsional resistance. Heavy return flanges on lower edges of the reflectors preserves ever-lasting longitudinal straightness. Sockets are metal-clad and metal-backed, and are seated in tapered die-formed housings which can be instantly removed in continuous row installations for socket replacements.

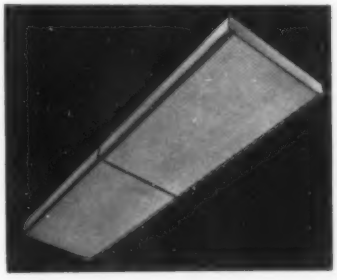
All models of these new series may be easily mounted on surface, chains, or stems. Both series are available in two- and three-lamp, 48-inch fluorescent, rapid-start, and 430 slimline; and 96-inch 430 ma slimline and 800 ma rapid-start.

For additional data, ask for item P-1015, using the coupon on page 139.

New fixtures designed for low-ceiling lighting

A DISTINCTIVE new series of lighting fixtures called the Boston series is being introduced by Eastern Fixtures Company, 170 Vernon St., Boston 20, Mass. It is designed for high-styled, low-ceiling lighting.

Less than 4 inches deep, the units are precision-built to combine shallowness and low-brightness lighting



with maximum economy. They are offered with either egg-crate louvre or vinyl plastic lens.

Eastern's Boston series fixtures are constructed with rigidly-framed plastic sides, cannot curl or warp. Hinges on both sides aid in easy maintenance. Louvres lower for convenient relamping. Full top reflectors provide peak lighting efficiency. One of the big advantages of this new series is its adaptability to surface-mountings which give a recessed appearance. It also lends itself to continuous row installation.

For additional data, ask for item P-1016, using the coupon on page 139.

Device for replacing lamps aids safety

THE RAYMOND JOHNSON Manufacturing Co., P. O. Box 7504, Oklahoma City, Oklahoma, has introduced their new "Reach-A-Lamp" device for servicing fluorescent and slimline lighting fixtures in hard-to-reach places.

With simple hand-operated controls, the Reach-A-Lamp firmly grips all sizes and types of fluorescent and slimline lamps—rotating the two-pin twistout type from the

sockets, or exerting pressure against the spring-loaded socket of the slimline type and moving the lamp away from the fixed socket while removing it from the fixture. It's mechanical dexterity also enables it to hold dust cloths or sponges in contact with the lamp or fixture surfaces for cleaning purposes. With the addition of a slip-on taper fit receptacle, most starters can be removed and replaced in either vertical or horizontal mountings.

Since the Reach-A-Lamp eliminates ladders in servicing light fixtures, it is a great aid to safety. It conserves manpower as the serviceman using it can maintain many times more fixtures than by ordinary methods, and it eliminates costly machine or equipment shutdowns, as most fixtures can be serviced without disturbing either work-in-progress or the operator.

For additional data, ask for item P-1017, using the coupon on page 139.

Fluorescent luminaire features side light beams

FOR HIGH STYLE, high comfort lighting, the Edwin F. Guth Company, 2615 Washington Blvd., St. Louis 3, Missouri has recently introduced Slimfin, the new, extra slim, swept-wing designed fluorescent luminaire

featuring side "Finglow" light beams.

"Finglow" side wing edges are molded of polystyrene plastic and are securely seated in the unit's steel side wings. Side beams add a soft uplight

News about people

Frank H. Roby has been appointed an executive vice president of **Federal Pacific Electric Company,** according to an announcement by the firm's board of directors.

Frank H. Roby

Before joining Federal Pacific, Mr. Roby was vice president and director of the **Square-D Company.** He had been associated with that firm since his graduation from Purdue University in 1933.

In 1950 Mr. Roby was elected a vice president and director, also serving on the board of Square-D Company Canada Ltd. and as managing director and board member of Square-D Ltd. of Great Britain.

As its new southern regional sales manager, **Day-Brite Lighting Inc.,** St. Louis, Mo., has appointed **Gordon Wells,** of Charlotte, N. C. Wells formerly represented Day-Brite in the states of Virginia and North and South Carolina. This area will now be served by his four lighting salesmen who will operate individual sales agencies as direct Day-Brite representatives. **John Manos** will be located in the Roanoke, Va., and Winston-Salem, N. C., trading areas.

Earl Dagenhardt

Roy Palmer, Jr., will handle Raleigh and Durham, North Carolina; **Earl Dagenhardt,** Richmond, Newport News and Norfolk, Va.; and **Ladd Massey** will represent Day-Brite in Charlotte, N. C., and Greenville, S. C.

Before becoming a Day-Brite representative 18 years ago, Gordon Wells was for 6 years a lighting engineer for the Georgia Power Company. He is a graduate of Georgia

Ladd Massey

School of Technology. His new position involves the sales management of 11 southern states including Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Arkansas, Tennessee, Kentucky, and Mississippi. His headquarters will continue to be 307-308 Builders Building, Charlotte 2, N. C.

Earl Dagenhardt has spent the last seven years in Virginia as a lighting salesman for the Wells Company. Ladd M. Massey joined Gordon Wells in 1950 after three years with an independent electric wholesaler as a lighting engineer. He is a 1947 graduate of Clemson University with a degree in electrical engineering.

Roy Palmer, Jr., has been with the Gordon Wells Company for two years. Before becoming a lighting salesman he spent a year at Day-Brite, in St. Louis, getting factory training. He is a graduate of Davidson College with a B. S. degree. John Manos also received his training at the Day-Brite plants in St. Louis and Tupelo, Miss. He has worked for the past year in the Charlotte office of the Gordon Wells Co., making lighting layouts and calling on local distributors and architects. He holds a B. A. degree from the University of North Carolina.

V. A. Elmblad, Southwestern District Manager for **Graybar Electric Co., Inc.,** announces the appointment of **E. J. Hoff** as manager at Fort Worth.

Mr. Hoff joined Graybar-Seattle in 1924 serving as part time janitor and stock records clerk while attending college. Since 1929 he has held various sales positions in Washington and Texas. He became manager of outside construction sales at Dallas in 1952 and in 1955 was made inside construction sales manager, the position held until his recent appointment.

Frank E. (Buzz) Harris, Jr., has been named assistant sales manager of the Tape Division of **Plymouth Rubber Co., Inc.,** Canton, Mass. Announcement of the appointment was made by James E. Fenn, division sales manager.

Mr. Harris is a Brown University graduate. He joined Plymouth three years ago, beginning as a sales assistant, and is thoroughly familiar with the products manufactured by the Tape Division.

Y. S. Hogg has been named manager of the Tampa district office for **Allis-Chalmers Manufacturing Co.,** Milwaukee, Wis. He joined A-C in 1949, shortly after his graduation from Alabama Polytechnic Institute, where he graduated with a B.S. degree in electrical engineering.

After completion of the Allis-Chalmers graduate training course in 1951, his first assignment was as a sales representative in the Atlanta district.

Gordon Wells

John Manos

Roy Palmer, Jr.

New products

Lightweight floodlight is mounted on pump island

CROUSE-HINDS Co., Syracuse 1, New York, presents the new MDB-10 pump island floodlight, a weatherproof, lightweight (4¼ lbs.) luminaire

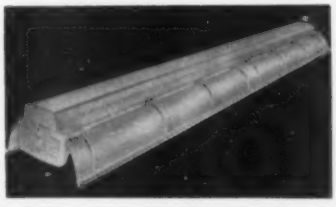
with a hinged door. Mounted on the pump island, the MDB-10 may be used to light driveways, building surfaces, or general areas.

With wide beam reflector, it is excellent for general area lighting, and when equipped with narrow beam reflector, it becomes an ideal spotlight for highlighting. Furnished with two feet of 2-conductor rubber-covered cable, the new floodlight takes 200-300-watt medium screw base general lighting service lamps.

For additional data, ask for item P-1014, using the coupon on page 139.

Industrial type fixtures are easily mounted and serviced

FLUORESCENT FIXTURES of California, 352 Shaw Road, South San Francisco, Calif., announce the new All-Brite line of industrial fixtures. The new line consists of RLM series 81, semi-direct and series 80 totally direct, equal in quality to



series 81 but not designed for RLM specifications.

Formed in one piece on All-Brite's new mammoth 300 ton hydraulic press brake, the reflectors are embossed with ribs for highest rigidity and torsional resistance. Heavy return flanges on lower edges of the reflectors preserves ever-lasting longitudinal straightness. Sockets are metal-clad and metal-backed, and are seated in tapered die-formed housings which can be instantly removed in continuous row installations for socket replacements.

All models of these new series may be easily mounted on surface, chains, or stems. Both series are available in two- and three-lamp, 48-inch fluorescent, rapid-start, and 430 slimline; and 96-inch 430 ma slimline and 800 ma rapid-start.

For additional data, ask for item P-1015, using the coupon on page 139.

New fixtures designed for low-ceiling lighting

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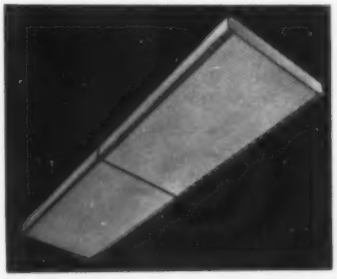

with maximum economy. They are offered with either egg-crate louvre or vinyl plastic lens.

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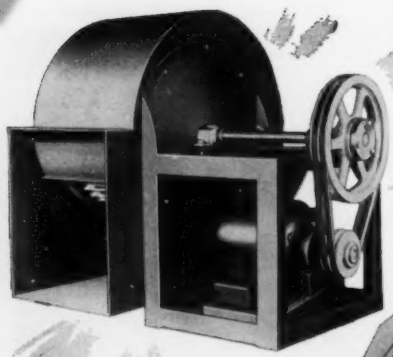
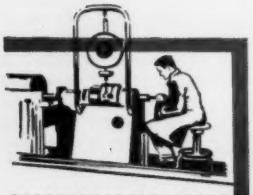


Peerless Belt Drive
Backward Curve Blower

Peerless Belt Drive
Centrifugal Roof Ventilator



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to pleasantly illuminate the ceiling, yet Slimfins provide highly efficient downlight. Fixtures are finished in glistening white Permalux and include handsome chrome end fins.

They are available with Gratelite louver diffuser, Prismoid Gratelite or metal cross baffle bottoms. Both Gratelites are molded of polystyrene plastic with built in ultra-violet light retarders.

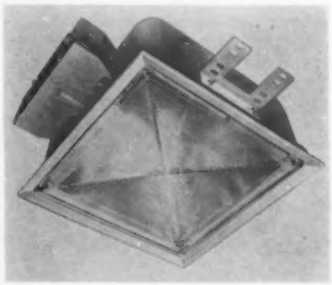
Slimfins are for close ceiling or pendant mounting, as individual units or in continuous row installations. Available in 4- and 8-foot lengths, in two- or four-light widths.

For additional data, ask for item P-1018, using the coupon on page 139.

Recessed light features single frame, large lens

A SINGLE FRAME only 5/8 inches thin, and the largest lens area available for a 12-inch square opening are a few of the many features of Uni-Frame, a new recessed incandescent lighting element introduced by Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

Two models feature the same sculptured styling and identical mechanical dimensions, and differ only in



wattage rating. Uni-Frame 200 handles 100, 150, or 200-watt lamps, Uni-Frame 300 takes 300-watt medium base lamps. One size adds a note of continuity to the ceiling area.

The Pyrex lens, 11-5/16 inches square, features "bifocal" prism design to boost light in the extremities of the distribution pattern. Frames are available in flat white enamel, anodized aluminum in brass, or natural aluminum. A rigid, seamless box requires no plaster frame and can be installed in poured concrete. Uni-Frame is designed to replace one 12-inch square ceiling tile, installs easily in all types of ceiling construction, and can be adjusted to compensate for ceiling materials of various thickness.

For additional data, ask for item P-1019, using the coupon on page 139.

Device protects mercury lamp against high voltage surges

AN IMPROVED 400-watt mercury lamp, expected to provide significant reductions in maintenance costs for street and highway lighting systems

which operate on straight series circuits, has been announced by the large lamp department of General Electric.

Listed as H1BA, the new mercury lamp is designed for 3.2 ampere straight series circuits. A new feature of the lamp is a built-in protective device against sudden surges of voltage through the line. This internal "cutout" eliminates the necessity for costly maintenance trips to replace presently used external film circuit cutouts after heavy electrical storms or other sudden surges of high voltage.

The new internal cutout allows the lamp to withstand higher voltage surges than do the separate external cutouts used until now. Thus, the lamp is permitted to operate without interruption throughout its normal useful life.

For additional data, ask for item P-1020, using the coupon on page 139.

Acoustical element used in over-all lighting systems

SOUNDSHEET, the new translucent acoustical element for over-all lighting systems, is now being featured as a dual purpose diffuser in Wakefield Ceiling '58, a modular lighting system manufactured by the Wakefield Company of Vermilion, Ohio, and London, Ontario.

In Soundsheet, manufactured by Contrex Company, Chelsea 50, Mass., acoustical and light diffusing properties have been combined. Soundsheet, in addition to its use as a shielding media in the wall-to-wall and area lighting systems is also being used to replace or supplement other acoustical or lighting media now installed.

In Wakefield Ceiling '58, two types of Soundsheet can be used: (1) corrugated Soundsheet, with its noise reduction co-efficient of .70, supported on T-bars with suitable hold-downs; and (2) flat Soundsheet, stretched in frames for drumhead tightness.

For additional data, ask for item P-1021, using the coupon on page 139.

Fanner Catalogs are known for their completeness of helpful information — selection tables, application data, step-by-step installation methods. The new Catalog EP-8 is more complete than ever before. You will see how FANNER's exclusive features, precision manufacturing, protective packaging and color coding work to advantage on a wide variety of applications.

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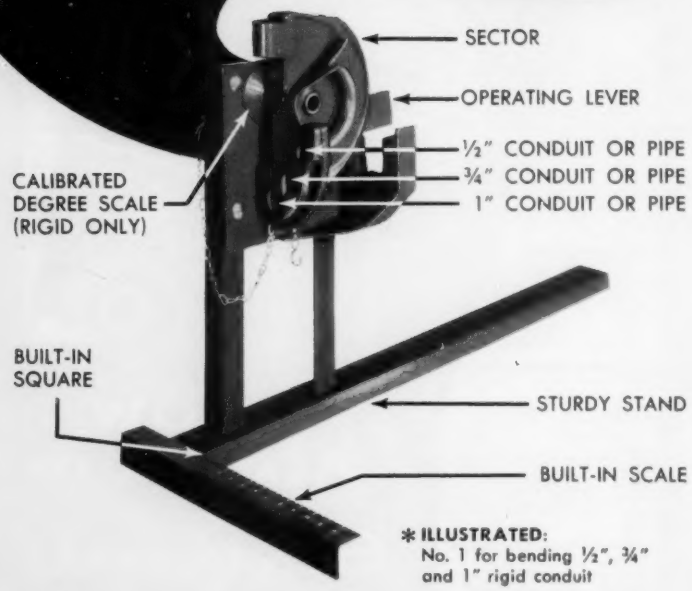

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1¼" conduit or pipe	7¼"	EMT 9½"
1½" conduit or pipe	8¾"	EMT 10½"

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LIDSEEN OF NORTH CAROLINA, INC.

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PHONE HAYESVILLE 2000

New fixtures adapted to today's modern homes

A NEW LINE of residential lighting fixtures, named Brass-N-Glass, is now being offered by the John C. Virden Co., 5209 Euclid Av., Cleveland, Ohio.

Combining the Danish and Italian influence with a modern blending of imported glass and polished brass,

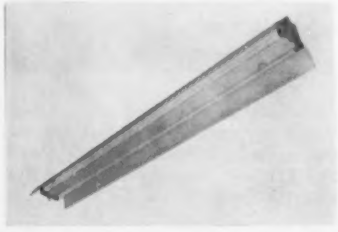
the new fixtures are particularly adaptable to today's modern homes.

The canopies over the shade in one of the fixtures of the new line are highly polished brass, perforated to give an attractive effect. The shades are imported glass in a milk white finish. The white cords are adjustable. Maximum height is 36", spread 26", and it accommodates 3, 100-watt lamps.

For additional data, ask for item P-1022, using the coupon on page 139.

Power-groove industrials have high lighting levels

NEW INDUSTRIAL fixtures, that use to maximum advantage the very high lumen output of the modern power-groove lamps, have been developed by Smithcraft Lighting, Chelsea, Mass. Smithcraft power groove industrials provide important economic



advantages in addition to comfortable lighting.

Power-groove industrials by Smithcraft are available with approximately 15% uplighting (PF series) and 25% uplighting (PV series); the uplighting is directed through scientifically designed aper-

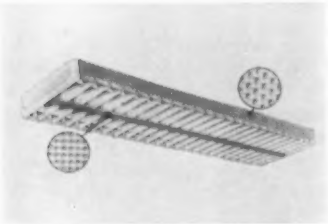
tures that are collared for extra strength. The fixtures may be purchased with louvers for 30° x 30° shielding on the PV series, and 16° x 30° on the PF series.

Available with porcelain enamel or white supercoat baked enamel ribbed reflectors, Smithcraft power-groove industrials feature low installation and maintenance costs. The units are quickly and economically mounted, individually or in continuous rows, by any conventional method.

For additional data, ask for item P-1023, using the coupon on page 139.

Fixtures meet aesthetic and functional needs

A NEW, POPULAR priced series of fluorescent lighting fixtures for use in schools, offices, and stores has been introduced by The Miller Company, Meriden, Conn. Called the Richmond, the new fixture family



offers features to meet aesthetic and functional lighting design needs.

Texture-Lite, with upward facing lancings in the metal sides, provide surface interest and a subtle, softly

Statement of Ownership

STATEMENT required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of ELECTRICAL SOUTH, published monthly at Dalton, Ga., for October, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, W. R. C. Smith Publishing Co., Atlanta, Ga.; Editor, Carl W. Evans, Atlanta, Ga.; Business Manager, Frank P. Bell, Atlanta, Ga.

2. The owner is: W. R. C. Smith Publishing Company, Atlanta, Ga.; Estate of W. R. C. Smith, Atlanta, Ga.; O. A. Sharpless, Atlanta, Ga.; T. W. McAllister, Orlando, Fla.; W. J. Rooke, Atlanta, Ga.; E. W. O'Brien, Atlanta, Ga.; J. C. Cook, Atlanta, Ga.; R. P. Smith, Atlanta, Ga.; Mrs. E. L. Philpot, Atlanta, Ga.; Mrs. Seba Jones, Atlanta, Ga.; A. F. Roberts, Atlanta, Ga., and Wm. C. Herbert, Atlanta, Ga.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

(Signed) Frank P. Bell, Business Manager.

Sworn to and subscribed before me this 8th day of September, 1958, Seba J. Jones, (My commission expires Feb. 23, 1958).

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3-WAY MOUNTING
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FIXTURE
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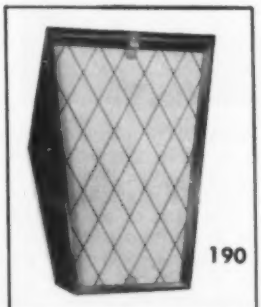

No. 192—A wasp-waist fixture designed to compliment the styling of modern construction. The symmetrical design of this fixture makes it equally attractive when mounted vertically, horizontally or on the ceiling.

No. 190—A traditional bracket lantern in a refreshingly new style. The grid design on the frosted globe accentuates the glossy black finish of the one piece molded fixture.

POST LANTERNS too . . .

No. 200—A smart blend of old and new designs. The frosted "prismatic" globe provides a soft, diffused light. The threaded globe and base plus a gasket protect the lamp holder from bugs, dust and moisture. Non-metallic base makes the fixture rust and corrosive proof.

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Automatic or Manual
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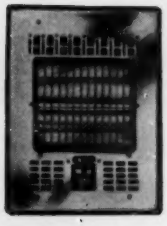

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Automatic &
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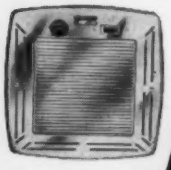
Fan-Forced
BATHROOM
HEETAIRES
Manual and
Automatic



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luminous effect. Lamps are shielded from direct view as light filters through hooded openings.

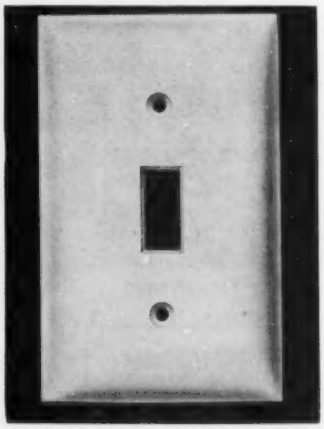
The Richmond is easy to install and maintain. It has a built-in channel connector for 2 lp. units, that makes continuous row installation easy, "U" shaped, translucent plastic side rails that provide continuous snug seating for side panels and lock with cross louver ends, an automatic aligning device for faster, more accurate alignment of shielding assemblies, and "twin" thumb latches at both ends of fixture which operate with slight finger pressure and are said to provide easy accessibility from either side.

For additional data, ask for item P-1024, using the coupon on page 139.

New wall plates eliminate dust-catching ridges

STA-KLEEN wall plates, that eliminate dust-catching ridges and remain clean indefinitely, have been introduced by the Slater Electric & Mfg. Co., Inc., Glen Cove, L. I., N. Y.

Designed for beauty as well as function, the new wall plates are



available in all sizes and types, from single gang to 4-gang, in both interchangeable and regular lines.

Slater Sta-Kleen plates are non-discoloring and said to be virtually unbreakable. In addition, they are unaffected by alkalies, acids, and weathering.

Of specification thickness, material, and weight, the new plates meet all Federal and municipal requirements, as well as all architectural specifications. They are available in black, brown, and ivory.

For additional data, ask for item P-1025, using the coupon on page 139.

Prismatic pattern controls fixture light distribution

SUNBEAM LIGHTING, 777 E. 14th Pl., Los Angeles, Calif., announces a new line of fluorescent Visionaire fixtures, featuring the Holophane Prismalume Controlens.

These new fixtures utilize the Holophane clear acrylic Prismalume panels, having a prismatic pattern which controls the light distribution. The total effect is to produce more efficient lighting on the work plane, with greatly reduced brightnesses from normal viewing angles. Each prismatic panel has vanes integrally moulded into it in both crosswise and lengthwise directions.

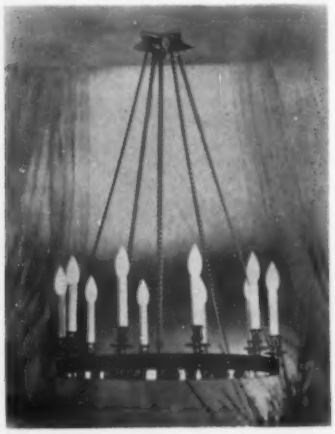
The single-element lens panel and its frame is released at the touch of a fingertip to the nearly invisible, touch-type latch, and it swings open for relamping on a full-length hook-on hinge. The entire panel may be removed, even from the four-foot square fixture, without the use of tools.

These modular fixtures come in sizes two-feet by two-feet, two-feet by four-feet, and two-feet by eight-feet, nominal, in the HRH3600 recessed and the QRH4600 surface-mounted series, and four-feet by four-feet, nominal, in the HRH3800 recessed and QRH4800 surface-mounted series.

For additional data, ask for item P-1026, using the coupon on page 139.

Elegance and luxury, key to lighting fashion show

JAY LIGHTING Manufacturing Co., 25 Quincy Street, Brooklyn 38, New York, announces the presentation of the Coronet Series of ceiling fixtures and wall sconces at its Showplace Showrooms, 7 East 35th St., N. Y. The



current productions total 25 in number, ranging from traditional to contemporary and transitional, with interesting originalities.

The Coronet series meets the rigid requirements of designers, architects and decorators, for dining rooms, living rooms, foyers, bedrooms, clubs, salons, showrooms, lobbies, boardrooms, executive offices, restaurants, or wherever elegance and luxury are desired.

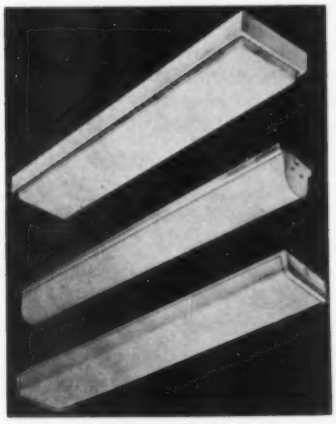
Fixtures are equipped with candelabra sockets or edison base sockets.

For additional data, ask for item P-1027, using the coupon on page 139.

Units provide direct or semi-direct lighting

THREE NEW SERIES of shallow fluorescent "PlastoLiers," incorporating a one-piece metal housing and one-piece snap-in plastic shielding are being manufactured by Metalcraft Products Co., Inc., Mascher and Lippencott Sts., Philadelphia, Pa. All are designed to provide low brightness illumination with even distribution when surface or pendant mounted, individually or in continuous runs.

One of the series, the Wrap-Around, provides direct or semi-direct lighting through an extruded polystyrene diffuser which wraps



around the bottom, sides and top of the one-piece metal housing. When pendant mounted, built-in uplighting is provided through plastic by openings in the top of the metal housing, without additional parts required. Wrap-Around units are only 3½ inches deep over-all including diffuser.

For additional data, ask for item P-1028, using the coupon on page 139.

Planned maintenance

(Continued from page 40)

dirty. Many fixtures are now made to permit an upward component of light which illuminates the ceiling for more comfortable lighting conditions. Unless the ceilings are kept white and clean, this upward light becomes lost, and the lighting level at the working areas is reduced.

Burn-outs and lamp aging

Although incandescent, fluorescent, and mercury lamps have an average rated life, some early failures may occur. Naturally, burnouts fail to provide the illumination level over the area where they are located and should be replaced with new lamps. However, as lamps age and approach their average rated life, burnouts will occur more frequently and the

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labor costs to replace lamps individually as they fail becomes excessive. Besides, several unnoticed hidden costs prevail which add up to unnecessary maintenance costs.

For example, in a fluorescent lighting system, here is the usual replacement routine when an employe sees a lamp burned out:

1. The burn-out is reported to the supervisor who phones the maintenance department.
2. A maintenance man is assigned to make the replacement. A requisition is made out, and he goes to the stockroom for a new lamp.
3. He goes to get his ladder and then goes to the department where the lamp is reported out.
4. He removes the burned-out lamp and replaces it with the new one.
5. He takes a few minutes for a social conversation with the onlookers, returns the ladder to the stockroom, and then goes back to the job he had been working on.

The average time for this replacement is about 20 minutes. At a labor rate of $3.00 per hour, this 20 minute spot replacement job cost $1.00 for labor and 84¢ for the cost of the lamp ($1.20 list less 30 per cent non-contract discount), or a total of $1.84. Proceeding on this basis, in a year's time, this spot replacement method becomes an expensive operation.

Group relamping is cheaper

How does group relamping work. The average life of fluorescent lamps is a long 7500 hours if lamps burn three hours for each start. At 10 hours per start which is a common schedule they average over 11,000 hours. Latest records show that at that schedule over 90 per cent of the lamps burn beyond 8000 hours, or about two years service. So if you group replace all lamps before that point, (about every 18 months) you eliminate most of your spot replacement trips. The group relamping method is like setting the dining room table for dinner. If you plan for six persons, you can make six individual trips to the pantry and bring in one plate at a time, or, you can make one trip and bring in six plates. It is as simple as that. Labor cost to cart a quantity of lamps to a given area and relamp on a production basis, is cheaper than a series of drawn-out spot replacements in the same place.

First, replace all your old lamps with new ones, but save about 10 per cent of the original ones which still look good. Then as burn-outs occur among the new lamps, replace them with the lamps you saved. When about 5 to 10 per cent of the lamps have burned out, generally after one and a half to two years operation, your entire installation will have burned most of the average life. At this point you group replace all lamps, again saving about 10 per cent for future replacements. In this way you avoid the rapid burn-out period as the installation approaches the average life point.

Here is a typical money-saving example illustrating a case where group relamping is the most economical way to replace lamps for a given period of time:

Installation of 10,500 lamps

Spot replacement @ $3.00 per hour for labor

10,500 lamps @ 79¢/lamp.....$ 8,295*
Labor cost @ $1.00/lamp.....$10,500
(20 min./lamp, 3 lamps/hr.)

Total $18,795

Group relamping @ $3.00 per hour for labor

10,500 lamps @ 79¢/lamp.....$ 8,295*
Labor cost @ 10¢/lamp.....$,1050
(2 min./lamp; 30 lamps/hr.)
Labor to replace 20 per cent interim burnouts @ $1.00/lamp.....$ 2,100

Total $11,445

*Non-contract purchases 30 per cent discount (excluding 2 per cent cash discount)

For a given period of time, there will be four spot replacements and five group relamping periods. Therefore, in this particular case the actual group relamping cost will be 125 per cent of 11,445 or $14,056. The customer saves $4,739 over the period.

Replacing mercury lamps

While the foregoing examples are based on fluorescent installations, systems of mercury and incandescent lamps can also be group relamped for best economy. General service incandescent lamps, designed for high efficiency, have an average rated life of 1,000 hours, and are used in locations where labor maintenance cost is nominal. Group replacement is recommended at 800 hours of burning.

However, where the 2,500-hour life Extended Service Lamps are used in hard-to-service locations, or where 2,000 hour R-57 reflector

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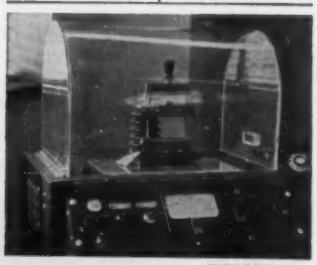
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GARFIELD, NEW JERSEY

lamps are installed in dusty or dirty locations to avoid frequent cleaning, these lamps should be group relamped at 80 per cent of average rated life.

Mercury lamps have a very long life ranging beyond 10,000 hours. As they age in service their light output drops off gradually so their average economical or useful life is about 7,000 burning hours. Group replacement should be planned at approximately this point. The best time can be determined by records of service hours or by light meter readings of the illumination in the area.

Hidden benefits

Not only is group relamping an economical operation, it has many other advantages. As lamps age, their light output drops off—gradually at first, but more so at the end of life. Since you are buying light for good see-ability, group relamping assures you of peak performance of your lighting system. Good lighting means more work output because employees can see better, have fewer accidents and less work spoilage, and their morale is better—all hidden benefits to the employer which save money.

High frequency

(Continued from page 45)

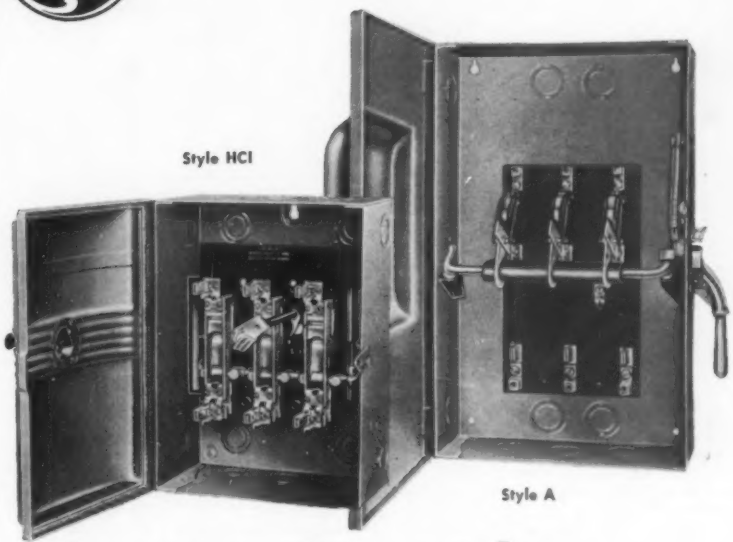
fact that they have moving parts which require periodic inspection and maintenance.

Rotary equipment of this type has been used up to this time in the majority of installations. It will probably continue to be used, particularly in the large installations where economics are important, where maintenance is not of a major concern, and where the load factor is high. Lighting for some industrial plants would be typical applications.

A fairly new static-type frequency changer offers considerable advantage for this application. These 540 cycle static type frequency changers have the lowest cost in small and moderate sizes. This device has no moving parts and has the reliability of a transformer. Like the motor generator, these units cost less per kva in larger sizes. This indicates an improved economic advantage for larger installations.

Transistor-type frequency changers of several types are being investigated. However, none are currently on the market. These prototype units are small in

SAFETY SWITCHES



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General Electric HCI heavy duty safety switches have operated successfully 50,000 times—an extra safety margin of 400% over standard U/L requirements.

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General Electric Company, Circuit Protective Devices Department, Plainville, Conn.

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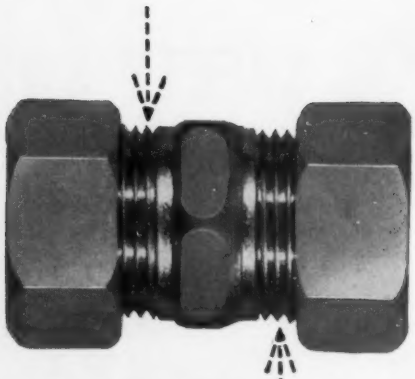

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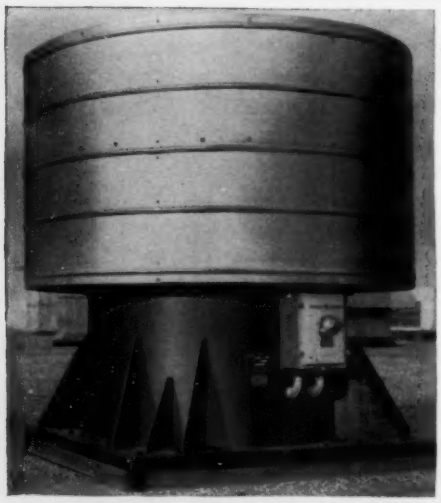
Blackhawk Industries, Dubuque, Iowa

Where the new ideas come from



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power capacity and are awaiting development of improved power resistors. Because of the lower voltages inherent in these units some of the expected savings in wiring is sacrificed. It probably will be one or two years before these units are sufficiently developed to determine their true worth in the high frequency lighting picture. Some of the more optimistic cost estimates have been used in Figure 2 to give a probable cost for these units if they were fully perfected and available in quantity.

Savings in wiring costs

A voltage higher than the standard 120 volts is usually used for high frequency lighting circuits. The voltage selected is between 230 and 600 volts, depending upon the lamps, ballast, and frequency changer. This increased voltage often leads to a savings in wiring costs. This savings can not be attributed to change in frequency, but it often makes up one-third of the over-all savings. This is particularly true in industrial plants where lighting branch circuits are comparatively long. Since a device is employed to change frequency, it can also be used to transform voltage to the optimum value for the best over-all economy without additional equipment cost.

Not all high frequency lighting systems cost less to operate. The concept of high frequency lighting is potentially a more efficient system than the 60 cycle lighting systems in current usage. Several of the high frequency systems can show operational savings.

For example, the 540 cycle static frequency changer with a modified capacitive ballast shows an over-all efficiency improvement of from 10 to 20 per cent, depending upon the 60 cycle system selected for comparison. If the area happens to be air conditioned, the monthly electrical bill is reduced still further in comparison.

Comparative job cost

To be more explicit, a typical job may be considered. This building is a combination industrial office and factory. The building was engineered for both 60 cycles and 840 cycles. Installed costs were determined for each condition. The cost break-down can be seen in Table 1. Many of the advantages of high frequency were not possible in this building because of building limitations. This installation was not selected to show

maximum savings but rather to point out where savings might appear in an average installation.

The same number of fixtures were used in the office area under either condition due to design limitations. However, the number of fixtures in the factory area could be reduced from 426 to 366 by using high brightness lamps. The same 800 ma rapid start lamp was used in both cases, but in the case of the 840 cycle system the lamp current was increased to 1000 ma to provide the same illumination with fewer fixtures. The total connected electrical load could be decreased from 119 to 99 kw or a reduction in connected load of about 20 per cent. The over-all initial savings in this particular building, by using the 840 cycle system, was slightly over 10 per cent.

Local conditions did not permit the use of a higher voltage 3-phase distribution for lighting at 60 cycles. However, if a 277/480 volt distribution were available, the savings by using the high frequency system would be reduced to approximately 6 per cent. The air conditioning required for the office could be reduced 1½ tons. This was not a sufficient amount to make any reduction in the capacity of the air conditioning unit installed.

A savings in operating cost is estimated at $1000 per year. Over the life of the installation, this figure becomes more significant than the initial savings. Many installations can show increased savings if full advantage can be taken of savings resulting in wiring, reduced number of lighting fixtures, reduced cost of ballast, and savings in air conditioning.

There are several high frequency systems being utilized at the present time. By matching the best suited system to the particular job conditions it is often possible to install an improved lighting system at a reduced initial cost. Savings in ballast, fixture, air conditioning, and wiring costs usually are sufficient to install frequency changing equipment and show a modest dollar savings.

By proper selection of over-all system design, operating costs can be reduced 10 to 20 per cent. High frequency lighting is not applicable at the present time to smaller installations where the fluorescent light load is less than 50 kw. The use of high frequency lighting in moderate and larger installations may be considered one means of stretching the construction dollar.

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Creative lighting

(Continued from page 39)

says. "It's quite possible the architect specified the wrong kind of lighting for the job, as for example, lighting of such intensity as to cast a supermarket glare in a quiet beauty salon. You must show as much earnestness and concern over a small job as a big one, because one can easily lead to the other."

Bell finds that in commercial work, alert merchandisers can be made to understand that carefully planned lighting is a dynamic factor in moving goods, in that it gives merchandise sales appeal and is one of the most versatile mediums at the architect's command for developing an atmosphere appropriate for the type of business and its merchandise.

Effect of lighting on sales

While sales increases cannot always be definitely attributed to one factor in a given store, it has been proved that increases of from 20 to 40 per cent in dollar volume are not unusual for stores where the only modernization was improved lighting, planned along sound, functional lines.

The results of a recent survey proved Bell's claim of the potentialities of a proper lighting system. The results showed that many businessmen visualize fixed operating costs in terms of square foot space, and on this basis the annual operating cost of a good lighting system stood next to the lowest item on a list recording such expenses as salaries, rent, advertising, taxes, lighting, and telephone.

In cases where gross sales went up to 25 per cent, the cost of the lighting system was only 3½ per cent of the gain. Obviously, a lighting system tailored to fit the customer's needs can be expected to pay its way and leave a good profit margin besides.

An idea of the lengths to which the Sarasota contractor will go to create a custom-built lighting arrangement is revealed in a prize-winning night club installation.

The problem was to secure even, adequate illumination at different ceiling levels to create an undersea Neptune aura.

Bell ruled out recessed and fluorescent fixtures. After three months of experimentation with palm fronds, star shells, and various types of commercially-styled lamps, he ordered 164 kingsize starfish from the Bahamas. They were allowed to dry out naturally, sprayed with clear lacquer and then gold and silver tinsel, and water and fireproofed with sealer. A special bulb with half its bottom silvered was suspended below each starfish on a bracket worked through the starfish center. The bracket was painted black to match the black ceiling, so that only the starfish was illuminated.

For continuity of design, more starfish fixtures were placed outside on the overhang of the building, and Bell installed subordinate lighting to spot the club's pianist. An aftermath was refraction of the entire installation of interior fixtures which extended out over a swimming pool through glass curtain walls. The net effect gives an illusion of stars, with the pianist suspended in space.

Another job in night club lighting was an installation in a bar called Far Horizons which was in

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the form of a half-moon. Bell carried out the astronomical theme by using illumination with black light and conventional fluorescents on a specially built time clock which turned on the black light, turned it off, and turned on the fluorescents, on a 45-second cycle. This created a lighting perspective of depth and breadth so that under conventional light, customers could see the stars in the firmament. Under black light, the scene was animated to portray a club-swinging caveman dragging a woman to his lair.

Lighting and outdoor living

"More and more homebuyers are looking for houses with outdoor lighting facilities," says Bell, "and this means that the contractor has an opportunity to introduce color and special effects for the inside as well as the outside. He can submit an alternate plan that includes underground wiring and permanent outdoor-type outlets for appliances like hedge clippers, lawn mowers, portable TV and radio sets, rotisseries, etc.; all of which will give the whole family extra hours of evening enjoyment outdoors."

Bell feels that builders are recognizing that well-planned lighting, inside and outside the house, along with the judicious use of color, paves the way to sales. Lighting outdoors imparts a feeling of homey warmth and casual outdoor living, and prospective homebuyers who are only able to househunt during the evening hours, are already presold on outdoor lighting since they have seen it advertised in select magazines, and at home shows.

"Take a large living room with window drapes," says Bell. "Since drapes lend themselves to corner or valance strip lighting, we find out what color drapes are to be hung, then we suggest the type of lamps that will enhance and not annihilate the decor. For example, where the drapes are gold, sun gold lamps will charge the atmosphere of the room with pleasing excitement."

"Take a store that dispenses women's wearing apparel. Such merchandise needs to be shown off with a subdued effect, since the entire tempo of such an establishment is geared to a quiet atmosphere.

"To achieve this intimacy, the contractor may need to design lighting troughs and fixtures in an uncharted field, because they're impossible to obtain through con-

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TUMBLE TYPE TOGGLE BOLT

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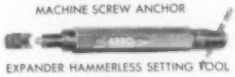
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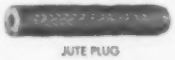
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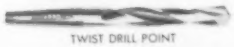
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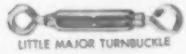
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2. **LONG TIME-DELAY.** Safely starts heavily loaded motors without blowing. Prevents circuit "outage" caused by heavy motor-starting currents or load swings. Provides "matched" protection for your motors.
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* U.S. Patent Nos. 2,111,749 – 2,300,620 2,321,711

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Tri-onic – "Awake At The Switch"

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Subsidiary of I-T-E CIRCUIT BREAKER CO., Philadelphia, Pennsylvania

Est. 1893

Tri-onic® C-Q-T® TRIONET® and O-T

ventional fixture channels.

"That's bad? That's good! You've created an original installation that you can show off to architects and builders and other businessmen.

"By offering them your services, as outlined in your alternate plan which reflects an intimate knowledge and study of their needs, you're taking a variety of details off their shoulders. Once convinced your ideas are constructive and not 'ivory tower' visions, you'll get better jobs to do.

"And if we contractors thus arouse public awareness of what constitutes a wiring system, adequate electrically and custom built to fit the customer's needs, we'll do jobs we're proud of; we'll boost the contract price, and we'll make money."

Problem of under-lighting

A while back, and despite acceptance of lighting as an important factor in merchandising, extensive surveys sponsored by the National Electrical Manufacturers Association, revealed that approximately 85 per cent of all commercial and industrial occupancies are underlighted! This would seem to point up Bell's contention that contractors need to do some creative thinking that will lessen such dour statistics. At the same time they would give themselves an opportunity to profit financially and help to turn a trade into a profession.

Contractors tell how

(Continued from page 103)

mate number of manhours it will take to complete almost every kind of assignment.

I have personally tested in actual practice some of the figures given, and the book is highly reliable. It certainly has saved me a lot of time that I would have spent figuring the number of manhours a job would take. As an example of the degree of detail included, tables are further broken down to show the differences that result if the ceilings are high instead of low.

This book is also of the loose-leaf type, so that the supplements sent by the NECA can be added to it without difficulty. This book, like the first one I mentioned, also must be returned should the contractor decide to cancel his membership in the Association.

The ability to stay in business successfully depends a great deal

on the man and the way he conducts his business. For instance, I have always made it a practice to personally check the progress of jobs being done by my men. This way I know the job is being done right, and any faults I might find can be corrected so as to prevent the losses that would result from having to do the job over. This idea of getting it right the first time is a big factor in my business.

I take great pride in the quality of the work done by my company. Often I will do a job and never hear anything else about it. I am not worried about that, because I consider it a mark of accomplishment, of a job well and satisfactorily done. Just because you do not hear anything more does not mean that the customer has forgotten you. Ultimately, quality work will pay off. For example, someone called us recently to do some wiring in her home. The only reason she called me was that I did the original wiring for the house over 20 years ago.

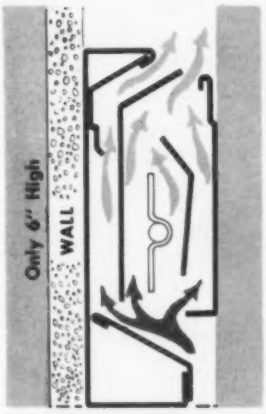
The question arises as to how a contractor can get such quality work from his men. I cannot give the whole answer, but part of it lies in the pride a contractor has in his men. I will not keep a man very long if I see that he does not do his job well, for the contractor must take real pride in being able to say that he has a group that does the best work at all times. I have never hesitated to compliment a man on his work if I think it is particularly good.

Part of this feeling of pride must be shown in the trust the employer has in his men. Each of my men has a key to my shop. They are free to come and go anytime. I figure if I cannot trust them there, I could never trust them in the homes of my customers. And several of my men have shown that they appreciate the interest shown in them, for one of them has been with me for 11 years, and another worked here for 35 years before retiring.

After a job is completed, I quite often make it a point to inquire about it later. This often results in other jobs. Not long ago, for instance, I met a men for whom I had done some work, and just happened to ask whether the job had been done satisfactorily. He replied that it most certainly had been and invited me to come over to look over another job he needed to have done. This simply shows that a customer appreciates the interest shown in him and in the work done for him.

NEW

Cavalier improved
BASEBOARD
with FULLY ENCLOSED ELEMENT

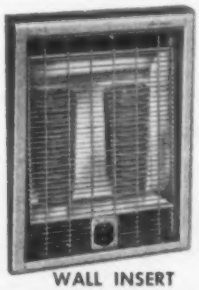


Vertical fin welded continuously to element sheath helps radiate heat, does not obstruct air flow. Construction eliminates dust traps. Heated air is thrust out into room, away from walls.

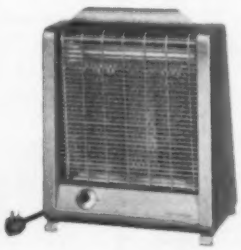
Now, the heating element in Cavalier Baseboard is fully enclosed in tubular steel sheath—same type proved so reliable and long-lived on electric ranges. Yet the maximum surface temperature never exceeds 125°F.—a Cavalier exclusive feature that's an extra buying reason for those with children. Heating output is full 200 watts per lineal foot.

You save time and materials with Cavalier Baseboard! Fewer interlocking sections required, convenience outlets (duplex 115V) and Cavalier's high quality liquid-filled thermostatic control sections build right into the lineup. Saves labor and run of wire across room to wall thermostat. No carpentry, installs on wall surfaces. No moving parts, nothing to wear out or cause trouble.

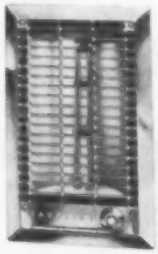
The only system ever discovered that puts the heat where it belongs. Installs at floor level along weatherside walls. Most satisfactory automatic heating system yet devised! Your customers will love it!



WALL INSERT
1 to 5 KW



PORTABLE
2, 3, 4 KW



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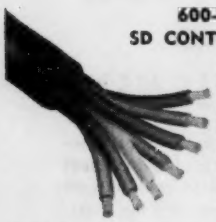
POWER and CONTROL
CABLES

Insulated and jacketed with modern plastics

600-1000V SD CONTROL CABLE



Flexible stranded conductors insulated with polyethylene. Nylon jacket over insulation provides extra protection. Mylar tape over cabled conductors, polyvinyl chloride outer jacket.

POLE & BRACKET CABLE

For use from street lamp base or overhead circuit to lighting fixture. Insulation is polyvinyl chloride, jacket is polyethylene. Operates at relatively low voltage between conductors, high voltage from conductors to ground.

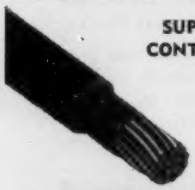
600-1000V STATION CONTROL CABLE

Conductors insulated with polyethylene. S. I. C. rating (2.3%) and Power Factor rating (.0003) remains constant at high frequency. Mylar tape over cabled conductors, polyvinyl chloride jacket overall.

FIGURE 8 POLE & BRACKET CABLE

For 0-600V service. Insulated with polyvinyl chloride. Does not deteriorate with age or weather, resists abrasion and mechanical damage, is not affected by common chemicals nor electrolysis. Will not support combustion.

SUPERVISORY CONTROL CABLE



Conductors polyethylene or polyvinyl chloride insulated. Polyethylene or polyvinyl chloride jacket. With or without shielding. Color-coded to IPCEA specifications or as desired. Composite types with twisted pairs available.

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Polyethylene insulation with polyvinyl chloride jacket or special polyethylene jacket. Highly resistant to most acids, alkalies and chemicals usually found in corrosive soil areas.

STREET LIGHTING CABLE

Thermoplastic series lighting cables for direct burial, in ducts or overhead. Highly resistant to earth acids and alkalies, moisture, sunlight and weather. With either polyethylene or polyvinyl chloride insulation and either polyethylene or polyvinyl chloride jacket. Shielded types available.

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SUPERIOR CABLES are manufactured under a rigid quality control system and are thoroughly tested prior to delivery to assure satisfactory performance.

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SUPERIOR CABLE CORPORATION

Hickory, North Carolina

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I have been doing work for some of my customers for years. One way I keep their business is to remember little personal characteristics they might have. If a woman is a careful housekeeper and doesn't want a lot of disorder as a result of the work being done in her home, I remind the man I send out to do the work as neatly as possible. I definitely feel that nothing can replace the personal touch in encouraging a customer to call again.

High level lighting

(Continued from page 41)

output units are employed with the primary side of the ballasts wired for the higher voltage, which permits switching larger groups of fixtures than those used on conventional 120-volts, and this, in turn, means less circuits in the panel."

Fixtures are in continuous rows spaced 7 feet, 6 inches on center with a ten-foot mounting height, and the total area thus illuminated is 45,000 square feet. Shipping and storage areas are lighted to 50 footcandles, using the same industrial fixtures on wider spacing, and temporary offices are similarly lighted to 50 footcandles. Each bay was wired with a row of trolley duct for bench receptacles.

Economy the selling point

"We sold EMR on the first 277/480-volt job in this area on the basis of economy," said Mr. Brumbaugh. "For example, the motors used on the plant's air conditioning system are too large to run off 208 or 230 volts economically. By going to 440 volts on the motors, it was to our advantage to take the lighting off the 440 with 277, thus saving transformers, excepting for the small number of receptacles for power tools and a few lights that required conventional voltage.

"Again, we saved on copper, since the size of wire on such wiring jobs is a major item."

Lamps used are high-output, rapid start, and the louvers on the bottom eliminate glare.

Previously, EMR plant officials had provided 30 to 35 footcandles of illumination for general lighting, with enough added lighting over the workbenches to raise this to 75 to 80 footcandles.

For a little extra cost, Brumbaugh supplied a lighting system providing 125 footcandles for general lighting, with the idea that if

any additional local lighting was found necessary, very little more would need to be installed.

The safety factor

It is Engineer Brumbaugh's opinion that it is much safer for plant personnel when there is little contrast between general lighting and supplementary illumination; since otherwise, workers may move from a brilliantly-lit area or workbench to lower-level lighting and stumble into accidents.

"The installation was so satisfactory," said Brumbaugh, and management so conditioned to higher-level lighting that for the new addition they immediately demanded 90 footcandles for their offices!".

A side light of this installation points up the fact that Florida is benefiting tremendously from the establishment of such industrial organizations. At a time when tourist dollars have fallen below expectations and damaging freezes have plagued agricultural interests, the steady payroll growth of such organizations as Electro-Mechanical Research has added materially to the state's economy. EMR, for example, now employs over 400 employees with an annual payroll of $1.5 million.

While the vast missile and electronics industry has created over 40,000 jobs in Florida during the past three years, this working force will not depend entirely upon military developments. The Florida State Development Commission reports that 80 per cent of the missile and electronic firms engaged in work on defense contracts could convert to non-military production with very little difficulty.

Remote control

(Continued from page 43)

on duty at the main desk can set this recycling in motion with the touch of a switch, without the operator having to take the time to throw a ball to recycle.

Switch lights on the trouble light master control panel indicate the presence of any malfunctioning of the alleys. The touch of a button at his scoring table by a player notifies the shop, sounds a horn in the maintenance area, and lights a switch button at the control center at the main desk.

Instant control of foul line lights from the main desk is now possible. By simply touching the buttons on the master control panel, the man on duty can activate foul

Revere Poles for Floodlighting

1. Square hinged poles (199-G Series) in 18, 20 and 24-foot mounting heights for 1 or 2 general purpose floodlights. Made of seamless steel tubing, with 2½-inch upper section, 3-inch lower section. Pole tops have 2-inch threaded nipples for brackets.

2. Heavy duty square tapered hinged poles (199-E Series) in 20 and 24-foot mounting heights, for 1, 2 or 3 floodlights. Tapers from 2⅜ inches to 4¾ inches. Base has 8-inch bolt circle. Pole tops have 2-inch threaded nipple for floodlight mounting brackets.

3. Heavy duty square tapered hinged poles (199-D Series) in 30-foot mounting height for 1, 2 or 3 floodlights. Tapers from 2⅜ inches to 5⅜ inches. Base is made of cast steel, welded in position, and has 11-inch bolt circle. Pole tops have 2-inch threaded nipple.

4. Extra heavy duty hinged poles (No. 199-DB Series) in 30-foot mounting height, for the Ultra-Lite Luminaire or floodlights up to 180 lbs. Tapers from 3 inches to 5½ inches, has 11-inch bolt circle. Pole tops have 10-inch long (3-inch dia.) threaded pipe stub.

5. Octagonal tapered rigid poles (560 Series) in 20, 25 and 30-foot mounting heights for 1 to 5 mercury or incandescent floodlights. Made of 11-gauge *Cor-Ten* steel. Tapers from 3¾ inches to 7 inches. Pole tops furnished with 2 or 3-inch threaded nipple.

6. Rigid poles (115 Series) in 20 to 60-foot mounting heights, for up to 10 floodlights. Made of standard steel pipe in separable lengths of 22 feet or less. Pole tops have 3-inch threaded pipe stub. Poles available for base and bolt mounting or concrete mounting.

Write for catalog of Revere outdoor lighting equipment

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line control for each set of paired alleys to be used for tournament play.

This low voltage switching system is more than a system remotely turning on lights, for its lighted buttons give an added direct knowledge of light control. In such an operation as this recreation center, the use of this system reduced the over-all cost of the building, since it gave the necessary measure of convenience and utility with a minimum amount of product cost, offering also flexibility resulting from no-conduit installation of low-voltage switching circuits. With the use of this system, space as well as equipment was saved.

Illumination levels

(Continued from page 35)

most of the tools available to do the job.

One guide, for the moment, is that varying the general level of illumination is less effective than varying the contrasts within a space. Another is that the variations must be at a slow enough rate so that they are noticeable. This will vary depending on the area. In an office, the spotlighting of a picture might go from 100 to 1000 footcandles over a period of five minutes or so, but in a store it might be more like 30 seconds to a minute.

Summary: Some installations today meet one or two of the above five objectives but none meet them all. (We are going to try to meet them all in the new office-school center in the Institute.) It seems clear that the above establishes the direction of lighting progress for at least the short-range future. (It seems now as though the five areas are fundamental enough to be good for all-time but maybe they're not.)

Establishing the direction of lighting progress in one area we all think about a great deal. Another is *rate* of lighting progress. Historically, the recommended levels of illumination have increased in about this way: 1918, 5 ftc; 1938, 20 ftc; 1943, 50 ftc; and 1958, 100 ftc.

We are now at the hundred footcandle level for most lighting fields and based on this pattern, can anticipate recommending optimum levels for light-colored tasks in 1978 to 1988.

We are already installing illumination ahead of this timetable, and it may well be that with the tremendous research effort going on now and the increased acceptance of better lighting, that recommended levels will increase faster than indicated.

We must get the user to ask himself if he can *afford* inadequate present lighting systems. Even further, can he afford the inadequate system that he probably proposes to put in? Higher lighting levels are justified by the relative constant cost of lighting as compared with rising building construction and other costs. We must show the user that the increased production and sales that result from higher lighting levels offer economic justification of his better lighting.

When we realize that the average level of illumination in all areas today is about 35 footcandles, and when we realize that light sources are continually becoming more efficient and longer lived, it becomes obvious that *the time is now* to open the door for the future with new concepts.

Working 12 kv lines

(Continued from page 84)

especially in 12 kv work.

As has been pointed out earlier, there are other companies using comparable work methods. In a survey made in early 1957, nine member companies of the Southeastern Electric Exchange indicated that they were using conventional rubber protective equipment on 12 and 13.8 kv circuits. Methods of application were not uniform, however, with some applying the protective equipment from the pole using rubber gloves, the others from insulated platforms. There are other companies within the EEI group who are making the application of this hose with hot sticks.

According to this survey, too, there was a lack of uniformity in gloves being used. Some companies were using 10,000, some 15,000, and some 20,000 volt gloves on this work. These things, we believe, will correct themselves as time passes.

The accompanying photographs illustrate difficult covering situations. That is, difficult in that rigid fiber definitely cannot be used altogether, but the new Hypalon or Salcor coverings can assist. Bear in mind that these are trade names which refer in one case to a DuPont product and in the other to a mixture of Hypalon with natural rubber.

Figure 1 shows some of the first uses to which this equipment is being put. Bear in mind it's in proximity to, not on, 12 kv. Work is to be done cold and grounded on a 66 kv transmission, maintaining the 12 kv circuit energized. This means climbing through. The feeder and tap can be covered satisfactorily with fiber. The new blankets, however, should be used on the dead ends and extension links, with flexible hose for the jumpers. Climbing space would then be in either the left-hand far or near quarter.

Figure 2 is a view from the bottom side before the work started. Impossible without the proper covering.

Figure 3 is a better view of what needs to be done. It is a branch line running to your left from a 3-phase-12 kv feeder on eight foot cross arms at a sectionalizing point. 15 kv mechanical jumpers can be installed, after which the disconnecting switch jumpers all can be removed at the "hot" taps.

Looking from the other side, in Figure 4, you see the climbing space, the left-hand near quarter, after covering the left-hand and middle feeder phases.

The 15 kv jumpers, in Figure 5, used to clear the disconnects can be laid over the crossarm or their weight carried on a collar rope. Don't forget to cover that neutral dead-ending on the pole. In Figure 6, blankets on the dead ends and links, with flexible hose and insulator hood on the left-hand tap jumper, will provide clear, well insulated space. Climb on the back side of the lateral tap.

Figure 7 illustrates another job not quite so difficult. Again 15 kv - 15 foot mechanical jumpers were used to clear the disconnect arm. However, this will require cutting to save time, and the installation of a stirrup and "hot" clamp. From there on, blankets can be used over the dead ends and extension links. The climbing space is in right-hand near quarter. That neutral should be covered, too. This job could be done by covering the cutout and jumpers rather than cutting.

Figure 8 shows a disconnect to be jumpered to get clearance or covered, since these jumpers are "bugged" on. Also, covering on the left-hand and middle feeder phase, using both fiber and the new corona resistant coverings.

These are all typical jobs which one of our crews have recently encountered. A combination of rigid

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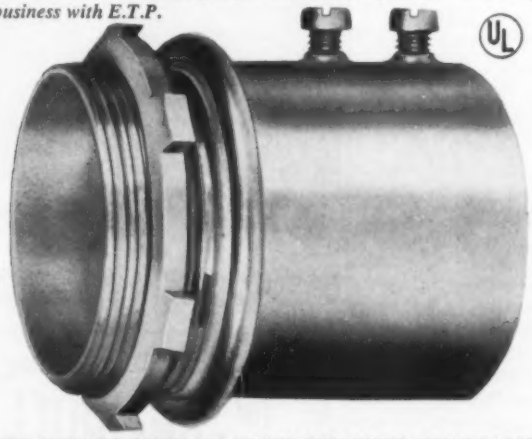

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and flexible hose solved these problems. These all represent work *in proximity to* hot 12 kv. We are now giving this new flexible hose the "works" to make certain that it will stand up.

As you can see then, this is in reality an interim report only. Our 1960 accident statistics will write the concluding remarks for this report. The individual ideas are not new. Some of your own companies already recognize the possibility of these safe work methods. A few of you have moved further already with this program than we have. If you represent one of those companies, to you should go the credit for initiating improvement in safe work methods on these higher distribution voltages.

Behind the scenes in the colorful work of a lineman is a daily battle by engineers and foremen like yourselves to provide the safe methods by which these men stay alive and in so doing, maintain the sound and steady heart beat of a great industry.

Narrow base towers

(Continued from page 76)

mounted on the structures, there was no further difficulty.

The towers for this line were designed to support 3 - 266,800 CM ACSR conductors and one 3/8" steel shield wire at the top plus 4 - 336,400 ACSR conductors at a lower level for distribution based on a wind load of 100 mph and a maximum span length of 400 feet. A bracket for the mounting of a future street light was also provided on each tower.

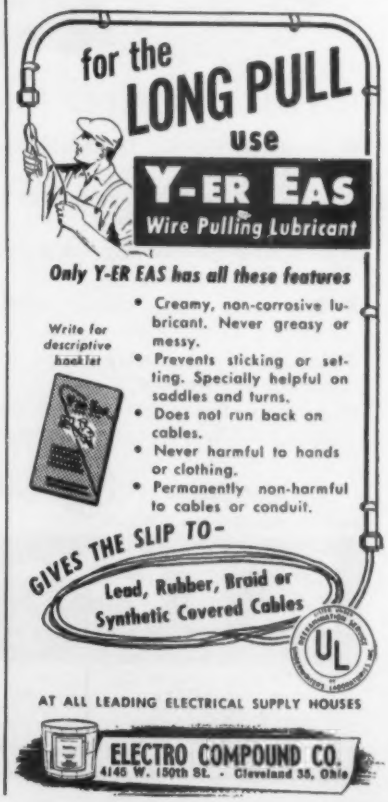
NEMA standard pincap insulators were substituted for the post type used on the previous line because we were unable to get delivery of a large quantity of post type insulators within the available time.

This line was energized in August, 1957. At present, two more lines using narrow base towers for part of the distance are in the design stage.

The narrow base tower combined with the use of post type or pin cap insulators can be used in many cases instead of an underground installation. The cost is somewhat greater than the usual type of overhead line but substantially less than that of an underground line.

These towers cannot be used where the building codes permit construction of buildings up to the property lines.

SunSwitch
DIVISION
RIPLEY COMPANY, INC., MIDDLETOWN, CONN.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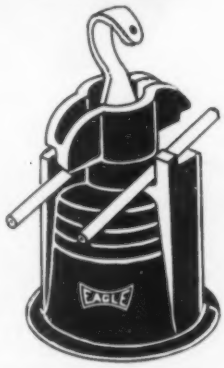

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Lighting progress

(Continued from page 42)

the ballast case height was reduced from 2⅜ inches to 1¾ inches. By reducing the width from 3⅛ inches to 2⅜ inches, the center "V" channel could be made even less deep. In fact, now it was possible to consider a fixture design limited in depth more by the lamp diameter than by the ballast cross-section. This was a significant development, and no one can doubt it for a moment.

The trend in modern commercial architecture was toward lower ceiling heights and less space between floors, thereby accomplishing esthetic appeal, making the office more like the home where lowered ceilings were already accepted, and reducing building costs.

The lower ceilings required fixtures closer to the ceilings to maintain the necessary distance between light source and desk top for proper illumination. Troffers were undesirable because of the space required above the ceiling to accommodate them. Also, it was the opinion of many lighting men that troffers were troublesome from the standpoint of heating problems. This stemmed from the fact that the Underwriters' Laboratories required heat tests only on recessed fixtures. These opinions we now know were erroneous, at least in the matter of degree when compared to the approach that was used.

This approach was to mount the fixtures directly to the ceiling, a logical and completely acceptable solution to the problem. But the elements of the new problem in the making are beginning to fall into place.

The ceilings most often consisted of an acoustical tile with excellent sound-absorbing characteristics, but for this very reason, extremely poor heat-conducting characteristics.

Lighting levels were raised in accordance with the findings and recommendations of lighting research. Seventy — eighty — one hundred foot-candles became the usual rather than the dreamed of. Fixtures employing more lamps

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were the answer. We were all rising to the occasion, but so was the ambient temperature surrounding the ballast in the fixture.

Ballast troubles increase

At first, the fixture manufacturers placed the narrower ballasts in the existing wider channels, and until they could re-tool for the narrower channels, the fixture ambient, though higher than before, had yet to reach its ultimate level. It didn't take too long for this to happen. Then we had all the ingredients. Shallow fixtures and small ballasts with less radiating surface were forced to dissipate their heat into a smaller channel, which was collecting radiated heat from more lamps, when mounted to a thermal insulating material. It does not sound so good, does it? Well, it was not, and in 1957, trouble began to appear in more and more installations, until every one was in full descent upon the backs of the ballast manufacturers.

After all, the ballasts were failing, therefore, it must be faulty ballasts that were causing the trouble. Oh, some were willing to agree that the ballasts were being overheated, but few were willing to believe that the overheating could be caused by anything other than the ballast itself.

Ballast research intensified

It is not particularly desirable to argue from a defensive position. More often than not, defensive argument is apt to be considered suspect. Therefore, we at Jefferson set out to establish the facts. We undertook a comprehensive fixture-testing project to determine the actual conditions existing in the field and to distinguish between cause and effect. Not, you must understand, to exonerate the ballast, but to learn *why* ballasts were failing. Unless we identified the problem, unless we knew the facts, we could not hope to solve the problem.

We found some startling facts in our investigation. I presented some of these facts in a paper delivered in Cleveland in November of 1957, and later published in the January, 1958 issue of Illuminating Engineering. The ambient temperatures encountered in certain types of totally enclosed surface-mounted fixtures were much higher than had been suspected.

We set about to combine our findings with data accumulated over the years in an attempt to predict the life expectancy of bal-

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lasts in these hot installations.

We know that our own data, as well as all the previously published data on ballast life, was interpreted against empirical considerations. There is, therefore, nothing sacred in the curves shown in the accompanying illustration. It is my contention that the curves are as statistically accurate as we are able to predict from the samples available to us and that they are of particular significance when compared one to another.

It is my hope that this information will stimulate others to procure similar data and to make it available to the industry.

Curve "A" represents the life expectancy of ballasts installed prior to 1955, and reflects the temperatures normally encountered in fixtures during the period 1940-1954.

Curve "B" covers the period 1955 - 1956, and reflects the initial impact of the smaller ballasts made available in 1955.

Curve "C" covers 1957 - 1958, and reflects the impact of the combined elements of the present heating problem.

It is clearly evident that ballast life expectancy is diminishing. One significant comparison that can be drawn from these curves is that one-half the ballasts installed prior to 1954 will fail in 22 years. Of those ballasts installed during 1954 through 1956, one-half can be expected to fail in 16 years. We expect only one-half of the ballasts installed in 1957 - 1958 to be operating 10 years from today.

Turning point reached

Alarming as this appears to be, I am much less concerned now than I was in the fall of 1957, for we reached a turning point at that time. As a result of forthright discussions of the facts, the heating problem became one in which both fixture and ballast manufacturer had a share—and a responsibility. The industry attitude shifted from "who do we blame?" to "how can we solve the problem?"

In October, 1957, the advisory board of the Certified Ballast Manufacturers proposed a joint industry committee to investigate the problem of ballast heating in fixtures. The first meeting of this committee, comprising representatives of the Certified Ballast Manufacturers (CBM), The Reflector and Lighting Equipment Manufacturers (RLM), and the Lighting Fixture Sections of the National

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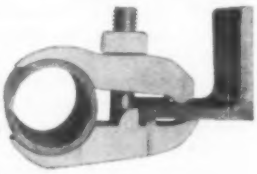

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(October 1958)

Electrical Manufacturers' Association (NEMA), was held in March, 1958, under the chairmanship of CBM.

The objectives of this committee are:

1. To select for test ballast-fixture combinations typical of those in which the ballast is subjected to temperatures in excess of the recommended maximum heat level to which the ballast components should be subjected.

2. To formulate a testing procedure for ballast evaluation which will be representative of ballast heating in severe thermal applications.

3. To work toward the end of having safety approval agencies recognize and enforce special consideration of ballast-fixture combinations which inherently overheat unless attention is given to the heat problems.

This is an ambitious program. At first glance, it appears to be insurmountable rather than merely monumental. This has been taken in stride by the committee. The problem is being reduced to discrete elements. As these are examined, evaluated, and resolved, the answers will be factored into the total problem. Such an integrated approach has aroused the enthusiasm of some of the finest talent in the fluorescent lighting industry. The accomplishments to be expected will represent a major forward step toward our ultimate objective.

This is true progress.

Reclosing practices

(Continued from page 81)

and more useful on sub-transmission and distribution circuits. As individual customer loads increase and larger size transformer banks are connected fairly close to the transmission station, the problem of coordination between substation line relays and customer station high-side fuses becomes more acute. In this case low-set instantaneous devices will supply better protection further out on the circuit and will operate for troubles in the nearby customer transformer bank, ahead of the high-side fuses. If the low-set instantaneous devices are removed from service by the reclosing relay, then the bank fuses operate and the main circuit may be restored to service automatically by the second operation of the recloser.

On a system that operates over a considerable area, we think that the relay engineer should put proper "first line" emphasis on the application, coordination, and operation of reclosing relays just as he does his protective relay system. After all, his protective relay system functions to interrupt service, and it is important to have just as reliable a system to restore service. If the devices for interrupting service function better automatically, the devices for restoring service will function better automatically.

Code discussion

(Continued from page 106)

ings with light is no longer unusual. Sometimes great clusters of these lights are mounted on roof tops as well as on poles and other independent structures. Care should be exercised to insure compliance with the Code requirements for overcurrent protection when making such installations.

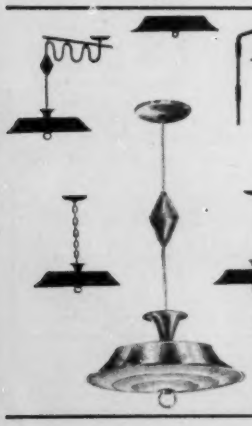
Sections 2403-d and 2121-c-2 require that No. 12 cord, as usually provided on floodlight fixtures, be not longer than 18 inches and be protected by a branch circuit overcurrent device not in excess of 50 amperes. The 50-ampere circuit is also the largest permitted by section 2126 for any branch circuit serving two or more outlets.

Yet, the tendency by some contractors has been to exceed this 50-ampere limitation and to exceed the 18-inch length. Sometimes a circuit larger than 50 amperes is terminated in a junction box in the vicinity of the cluster of floodlights. This circuit is then tapped with several pairs of unfused smaller conductors running several feet to each of the individual floods where they are tapped to the flexible cords supplied with the fixtures. These remote "branch circuit" overcurrent devices of 60 or 100 or even 200 ampere ratings may constitute suitable overcurrent protection for the cords and the smaller conductors in the minds of some contractors, but they do not comply with the Code requirements for such protection.

Some of these floodlight installations have been provided with no means of control other than the general-use type disconnect switch. Besides the unsafe feature of such a method of control, most such general-use switches, if so used, would rapidly deteriorate beyond use as a result of the arcing effects upon opening and closing. Figure 2 shows correct floodlight installation.

This discussion of overcurrent protection will be continued in the next issue.

Answers to the Code test questions are as follows: (1. **F** sec. 2403-a) (2. **T** sec. 2401) (3. **F** sec. 2403-a) (4. **F** sec. 2403-b) (5. **T** sec. 2403-c) (6. **a** sec. 2403-d) (7. **c** sec. 2403-d) (8. **a** sec. 2403-d) (9. **b** sec. 2403-g) (10. **c** sec. 2403-b)



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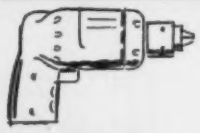

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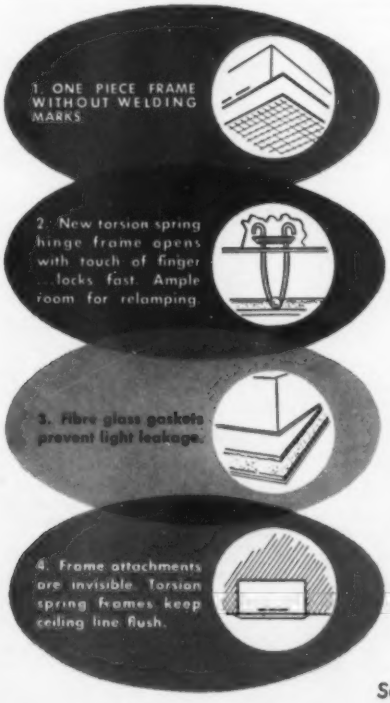
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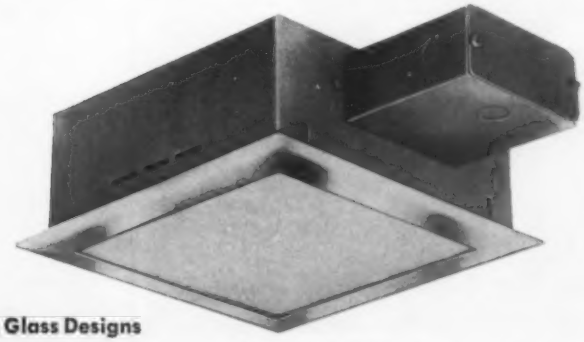

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ADVERTISER'S INDEX

A

Advance Transformer Co. ..... Second Cover
Accurate Mfg. Co. 122
Allen-Bradley Co. 26
Allis-Chalmers Mfg. Co. 92
American Steel & Wire Co.
U. S. Steel Co. 68, 69
Anderson Electric Corp. 59
Appleton Elec. Co. 7
Arro Expansion Bolt Co. 127
Arrow-Hart & Hegeman Elec. Co. 109
Atlas Elec. rods, Co. 139

B

B & C Metal Stamping Co. .. 64
Blackburn Corp., Jasper 63
Blackhawk Industries 124
Briegel Method Tool Co. 28
Bridgeport Fittings Inc. 140
Buffalo Forge Co. 124
Bulldog Elec. Products Co. ... 97
Bussman Mfg. Co. ..Back Cover

C

Cable Spinning Equip. Co. ..136
Carol Cable Co. Div. of The Crescent Co., Inc. 49
Cavalier Corp. 129
Certified Equipment Mfgrs. ... 51
Chance Co., A. B. 121
Champion Mfg. Co., Inc. 138
Chase-Shawmut Co. 128
Circle Wire & Cable Co. 61
Copperweld Steel Co. 85
Cornish Wire Co. 14

D

Day-Brite Lighting, Inc. 33
Delta Div. Light & Power Utilities Corp. 144
Delta Star Elec. Div., H. K. Porter Co., Inc. 87
Diamond Wire & Cable Co. .. 21
Dossert Mfg. Corp. 125

E

Eastern Fixture Co. 6
Electric Tube Products 133
Electrical Insulation Suppliers, Inc. 134
Electro Compound Co. 134
Elliott Elec. Products Co. ..136
EJS Lighting Corp. 19
Estimating Handbooks Associates 137
Eagle Elec. Mfg. Co., Inc. ..135

F

Fanner Mfg. Co., The 117
Federal Pacific Elec. Co. 11
Fisher-Pierce Co. 24, 25
Fullman Mfg. Co. 137

G

General Electric Co. Circuit Protective Devices Dept. 123
General Electric Co., Distribution Assemblies Dept. 30
Gibson Mfg. Co. .....Front Cover
Graybar Elec. Co. 13
Guth, Edwin F. 55

H

Helwig Company 138
Henderson-Hazel Corp. 135
Holophane Co., Inc. 31
Hotpoint Company 29
Hubbell, Inc., Harvey 16
Hunter Div., Robbins & Meyers, Inc. ..111

K

Kerrigan Iron Works, Inc. .. 8
Killark Elec. Co. 70, 71

L

Leviton Mfg. Co. 12
Lidseen of North Carolina, Inc. 118
Light & Power Utilities Corp. 2

M

Markel Electric Prods, Inc. ..120
The Miller Co. 23
Moloney Elec. Co. 65

N

Nutone, Inc. 5

O

Orangeburg Mfg. Co., Inc. .. 89
Osmose Wood Preserving Co. of America Inc. 136

P

Paranite Wire Cable Div. Essex Wire Corp. 18
Peerless Elec. Co., Fan & Blower Div. 116
Perfeclite Co. 15
Phelps Dodge Copper Products Corp. 72
Plymouth Rubber Co., Inc. ..126
Porter Co., Inc. H. K. (Delta-Star Elec. Div.) 87
Preformed Line Prods. Co. .. 32
Progress Mfg. Co. 17

R

The Ripley Co., Inc. 134
Republic Steel Corp. 107
Revere Elec. Mfg. Co. 131
RLM Standards Institute 20
Robbins & Meyers, Inc. 111
Rockbestos Prods. Corp. 91
Roebling's Sons, Inc., John A. 96

S

Sangamo Elec. Co. 53
Simplex Wire & Cable Co. .. 93
Smithcraft Lighting Div. 99
Southwire Company 1
Spang-Chalfant Div of National Supply Co. 57
Square D Co. ....Third Cover
Stephens, Inc., M. 126
Sunbeam Lighting Company .. 27
Superior Cable Corp. 130

T

Thomas & Betts Co. 22

U

Union Insulating Co. 119
United States Steel Co., American Steel & Wire Div. 68, 69
Tennessee Coal & Iron Div *

V

John C. Virden Co. 9

W

Wadsworth Elec. Mfg. Co., Inc. 136
Westinghouse Elec. Corp. ..66, 67, 94, 95, 112, 113
Wheeler Reflector Co. 133

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Following is a list of MANUFACTURERS' AGENTS who represent Advertisers appearing in *this* issue of ELECTRICAL SOUTH. Consult the Advertisers' Index on the preceding page for quick location of ads.

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Wheeler Reflector Co.

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All the quality, tested performance and economy that have earned Light & Power an enviable reputation in fluorescents are now available in incandescents, through L&P's new Delta Incandescent Division.

For instance, check these features of the Delta Concentric Ring:

1. Tapered heavy-gauge anodized aluminum.
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CONCENTRIC RINGS
(Also Available in Steel, Baked Enamel Finish)

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3 BOXES with plug-in interchanging components

REPLACE NEARLY 100 ASSEMBLED FUSIBLE DEVICES!

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Designed-in Quality

Aluminum and copper cable approval...Box lugs throughout...All circuits out either top or bottom...Fits flush in shallow walls—Many more time-saving features assure low-cost installations.

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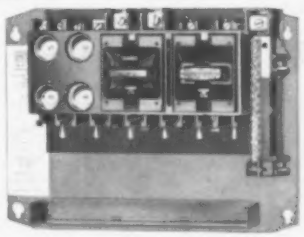
2 interiors, interchanging in each box, contain the neutral, basic pullouts and plugs, plus space to plug in extra branches. No need to buy the interior or cover until you are ready to trim-out.



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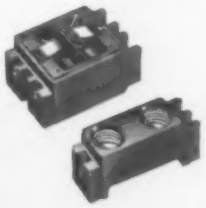
Plug fuse sections and pullouts plug on to the basic interiors, building the service to fit the job. No excess cost.



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SQUARE D COMPANY

"A bent shaft on an elevator motor might have caused a terrible accident

. . . *if Fusetron dual-element Fuses had not shut down the motor*"

PAUL M. BULL, Commercial,
Industrial Representative
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"As a Commercial and Industrial Representative for the Idaho Power Co., I was asked to redesign the electrical work for the Feed & Supply Center Inc., Twin Falls, Idaho. The installation was handled by Detweiler, an electrical contractor.

"When the job was completed, Fusetron fuses kept blowing on a 15 hp., motor that operates the elevator.

"Larger size Fusetron fuses were tried and the result was almost disastrous.

"When the motor started the whole elevator shaft shook as if it would tear apart. Everyone was afraid that at any second the motor and apparatus would come crashing down the shaft.

"Fortunately, the Fusetron fuses opened and stopped the motor.

"A thorough check revealed that the shaft of the motor was bent in transit.

"If Fusetron fuses had failed to open to protect the motor, there might have been a terrible accident."

You too, can benefit by the 10 point protection of Fusetron fuses.

Fusetron dual-element fuses offer the safest, most complete electrical protection possible. With rare exceptions on commercial and industrial installations — ordinary fuses and circuit breakers protect only against short-circuits — but Fusetron dual-element fuses provide 10 point protection.

Why Risk Losses! One burned out motor . . . one needless shutdown . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with Fusetron dual-element fuses.

Write for bulletin FIS.
BUSSMANN MFG. DIVISION

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Play Safe! Install FUSETRON dual-element FUSES throughout entire Electrical System!

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